Driver distraction in the European statement of principles on in-vehicle HMI: a comment

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Abstract

The recently issued 'European statement of principles on in-vehicle HMI' is reviewed with respect to what it contains on preventing driver distraction as it could be caused by in-vehicle HMI.

1. Introduction

On December 21, 1999, the Commission of the European Communities – which is the supernational equivalent to a national government - issued to member states a recommendation 'on safe and efficient in-vehicle information and communication systems: A European statement of principles on human machine interface'.

In the preamble to the statement the Commission provides the reasons for drawing up a recommendation of this type. Prominent among these is the following:

….. (3)'Whereas telematics devices inside vehicles will have an important impact on road transport in the near future and will provide valuable assistance to the driver under the condition that the driver is not distracted, disturbed or overloaded by the communication process and/or the information provided by the additional devices.' ……

Thus, the Commission shows an awareness of at least one of the central themes in the application of telematics for the purpose of providing in-vehicle driver support.

This paper scrutinizes the statement to see how the principles pertaining to this central theme have subsequently been formulated, i.e., in how far they are already steps towards achieving what the Commission had in mind. In doing so, I will restrict myself to what the principles say on driver distraction, i.e., leave out the 'disturbance' and 'overload' issues that the Commission also mentions. It is, incidentally, remarkable that another potential negative effect of in-vehicle supports is not at all contained in the list of what to fear for. This is, of course, the adaptation of driver behaviour to the new situation on a more strategic level, possibly resulting in so-called risk compensation (e.g. Verwey, Brookhuis & Janssen, 1996).

Although the statement does not actually contain a definition of 'distraction' it is generally clear what is meant: the capture of the driver's attention by information that is

irrelevant to the driving situation to a degree where insufficient attention is left for the primary task.

2. Review of principles

The principles, of which there are 35 in all, are divided into six categories.

2.1 Overall design principles

These clear the ground for what follows. Since there are only three of them, they can be quoted here in full:

> *'The system should be designed to support the driver and should not give rise to potentially hazardous behaviour by the driver or other road users.'*
>
> *'The system should be designed in such a way that the allocation of driver attention to the system displays or controls remain compatible with the attentional demand of the driving situation.'*
>
> *'The system should be designed so as not to distract or visually entertain the driver.'*

Of these three fundamental principles, the last one mentions 'distraction' explicitly, and the middle one is indeed a particular operationalization of 'distraction'. The first principle is so general that it could include anything, certainly the possibility of distraction. Thus, it is clear that distraction must have been very much on the Commision's mind when it formulated the overall design principles.

2.2 Installation principles

These five deal with the way in which in-vehicle systems should be positioned and fitted. It is not so much driver 'active' distraction as the possible obstruction of the driver's view and of controls and displays that is the subject here.

2.3 Information presentation principles

This category, which contains five principles, together with the next two forms the core of the statement. Several of the principles included in it deal explicitly or implicitly with driver distraction. One says:

'*Visually displayed information should be such that the driver can assimilate it with a few glances which are brief enough not to adversely affect driving.'*

Although this is not stated explicitly, it is clear that distraction is what is feared for to 'adversely affect driving'.

There is, of course, an ongoing debate on the quantification of the maximum allowable task load, either of a sensory or a cognitive nature, to be put upon drivers by in-vehicle devices. European experts, working on the further specification of the principles, are considering the proposition that four glances off the road for not longer than two seconds for any glance should be considered as a practical limit. Thus, five glances off the road would always be considered unacceptable, however brief they are.

The idea that there should be this type of discrete and, in fact, unidimensional cut-off criterion is probably untenable. For example, there is research from the US demonstrating that a continuous function underlies the relationship between glance frequency/duration and accident risk. Green (1999), elaborating on an earlier relationship derived by Wierwille (1995), has presented the following relationship between visual demand and the expected number of deaths in the US in year x as:

Number of deaths in U.S. in year x =

$$1.109 * (x-1989) * (\text{market penetration fraction}) * [-0.133 + [0.0447 * (\text{mean glance time})^{1.5} * (\#\text{ of glances}) * (\text{frequency of use/week}]]$$

The prominent feature of this equation is that the 'mean glance time' has more weight than the 'number of glances'. Thus, 4 glances of 2 s each are different in their expected effect from 2 glances of 4 s each: i.e., the product of glance duration and number of glances is not constant in its effect, and therefore not an appropriate criterion. Also, there is no apparent 'natural' cut-off point: the function has no knees or elbows. As a matter of fact, the following are combinations of glance duration and number of glances that are equivalent to the 4 glances * 2 s glance duration criterion in terms of the fatalities predicted:

1 glance * 5 s = 2 glances * 3.2 s = 3 glances * 2.4 s = 4 glances * 2 s = 5 glances * 1.7 s = 6 glances * 1.5 s (at any penetration fraction and frequency of use/week).

It would be recommendable to accommodate equivalencies of this type (i.e., trade-offs between glance duration and number of glances) in the further concretization of these principles.

In this context, it should be noted that the Commissions 'information presentation principles' neither contain a specification of allowable auditory task load, nor that of the combined load on the auditory and the visual channels. Of course, there is no equivalent of a number of glances * glance duration rule for the auditory domain.

The final principle in this category says:

'The system should not present information, which may result in potentially hazardous behaviour by the driver or other road users.'

Clearly, this is a rephrasing of one of the earlier 'overall design principles', and it adds nothing new.

2.4 Principles on interaction with displays and controls

This category deals with the 'hardware' of interacting with the displays and controls of the in-vehicle system. Again, preventing distraction appears to be a major concern in several of the 10 principles in this category. We have:

' The system should not require long and uninterruptable sequences of operations.'

What is meant by 'uninterruptable' is clear, but it is not stated what should be considered 'long'. Presumably, the 4 glances x 2s duration rule could be applied here as well in those cases where the operation of the system requires visual capacity.

Next we have:

'The driver should be able to control the pace of interaction with the system.'

And:

'The driver should have control of auditory information where there is a likelihood of distraction or irritation.'

And finally:

'Systems providing non-safety-related dynamic visual information should be capable of being switched into a mode where that information is not provided to the driver.'

As is the case for several other principles, these three are formulated in such a general manner that one can hardly be opposed to them. Making them more specific is a task foreseen in the so-called 5th Framework Program, the successor of earlier EU-programs dealing with – among others – in-vehicle HMI.

2.5 System behaviour principles

Two of the five principles in this category, which deals with the way in which the system per se should be designed, have to do with driver distraction:

'Visual information not related to driving that is likely to distract the driver significantly (e.g. TV, video and automatically scrolling images and 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.'

'System functions not intended to be used by the driver while driving should be made impossible to interact with while the vehicle is in motion, or clear warnings should be provided against the unintended use.'

While these are, again, very general principles they appear slightly less underspecified than some of the earlier principles.

2.6 Principles on information about the system

This last category deals with the instructional material to be provided to the driver for using the system, for understanding what it can and cannot do, etc. Distraction is not an immediate concern here. There is one principle, however, that implicitly presents a last warning in this respect:

'The instructions should clearly distinguish between those aspects of the system which are intended for use by the driver while driving and those aspects (e.g. specific functions, menus etc) which are not intended to be used while driving.'

3. Conclusions

- There is much concern for driver distraction in the principles, to the point where redundancy begins to appear.
- On the other hand, much of this is formulated in a vague and unspecific (underspecified) fashion. It is foreseen in the next stages of the European Framework Program that at least some of this should be resolved.
- Except in the principle on self-pacing (see section 2.4) there is little attention for the capacity people possess of regulating the level of distraction they will accept. The concept of the human information processor underlying the principles seems to be one of a passive receiver of information, onto whom stimuli from the environment impinge almost beyond control. However, this is only part of it.

References:

Green, P. (1999). Visual and Task Demands of Driver Information Systems (Technical Report UMTRI-98-16), Ann Arbor, MI: The University of Michigan Transportation Research Institute.

Verwey, W.B., Brookhuis, K.A. & Janssen, W.H. (1996). Safety effects of in-vehicle information systems. Soesterberg, TNO Human factors report TM-96-C002.

Wierwille, W.W. (1995). Development of an Initial Model Relating Driver In-Vehicle Visual Demands to Accident Rate. Proceedings of the 3rd Annual Mid-Atlantic Human Factors Conference. Blackbsurg, VA: Virginia Polytechnic Institute and State University, 1-7.