MULTI SENSORY INTEGRATION AND PERCEPTIVE IMMERSION IN DRIVING SIMULATOR EXPERIMENTS

Andras Kemeny

Renault, Technocentre
Direction du Développement de l'Ingénierie Véhicule
Centre Technique de Simulation
1, avenue du Golf
F78288 GUYANCOURT Cedex

LPPA, CNRS-Collège de France
11, place Marcelin Berthelot
F75005 PARIS

Abstract

Driving simulators are more and more used for vehicle design and driving human factor studies. Nevertheless how applicable is driving simulation is still unclear. There are listed some of the major issues with which engineers will be confronted in the next years.

Résumé

Les simulateurs de conduite s'utilisent de plus en plus pour la conception des véhicules et les études de facteurs humains. Cependant, l'applicabilité des simulateurs de conduite est encore à approfondir. Ici sont listés quelques uns des aspects majeurs auxquels les ingénieurs et les chercheurs seront confortés les années à venir.

The use of driving simulators is expanding. Industrial applications have been implemented on driving simulators in the last years [1], [2], [3], [4], [5] by car maker companies. Suppliers are now also using extensively driving simulators. [16]

If visual rendering quality seems well accepted by the automotive engineering community, the validity of dynamic vehicle behaviour is still under investigation. The importance of the contributions of vestibular stimuli was an evidence for automotive engineers who like to recall that they drive with their “backs”. This has been assessed recently through laboratory and psychophysical experiments [6].

Blooming effects for incoming vehicles
rendered in night conditions with SCANeR II©

Several other issues are still to be investigated:

- what are the acceptable transport delays in the synchronization of visuo-vestibular integration [7], [8], [9], [10].

- what are the best visual and vestibular perceptive movement gains to implement for an acceptable realism [11], [12].

The development of corresponding motion queuing algorithms is gaining a renewed attention. If the appraisal of a simulator can be made simply by estimating the cost of 1Kg (~300€ for Renault’s half-dozen different simulators from single dash board simulation to the high performance ULTIMATE dynamic driving simulator), the real value in use is heavily depending on the quality of implementations.

The high-performance Ultimate driving simulator

Important implementation aspects include:

- steering wheel realism quality [13] ;
- lateral longitudinal kinesthetic rendering [14] [15] ;
- visuo-vestibular integration (delays and amplitude values) [7].

I am convinced that during this conference you will find answers to these questions and will initiate fruitful debates with your colleagues.

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