UNIVERSITÀ
DEGLI STUDI
DI PADOVA

Scuola di Ingegneria
Corso di Laurea Magistrale in Ingegneria della Sicurezza Civile e Industriale

Fattori umani nella sicurezza dei sistemi di trasporto

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Driving Simulation Laboratory

Programma del corso

Corso a scelta
6 CFU (48 ore)
Docente: Prof. Riccardo Rossi

Parte I

1.Introduzione alla teoria dei sistemi di trasporto. Elementi di teoria del deflusso

i. *Sistema di trasporto stradale. Fenomeno circolatorio ed elementi caratteristici della circolazione stradale*
ii. *Condizioni di flusso ininterrotto*
iii. *Condizioni di flusso interrotto*

2.La sicurezza nei trasporti. Statistiche e trend evolutivi del fenomeno a livello nazionale e internazionale.

i. *Dimensioni del fenomeno. I costi sociali*
ii. *Politiche nazionali e internazionali*

Programma del corso

Parte II

3.Il fattore umano. Analisi dei comportamenti in contesti critici

i. *Il doppio compito*
ii. *Distrazione*
iii. *Fatica*
iv. *Effetti indotti dall'assunzione di sostanze*

4.Misure per l'incremento della sicurezza

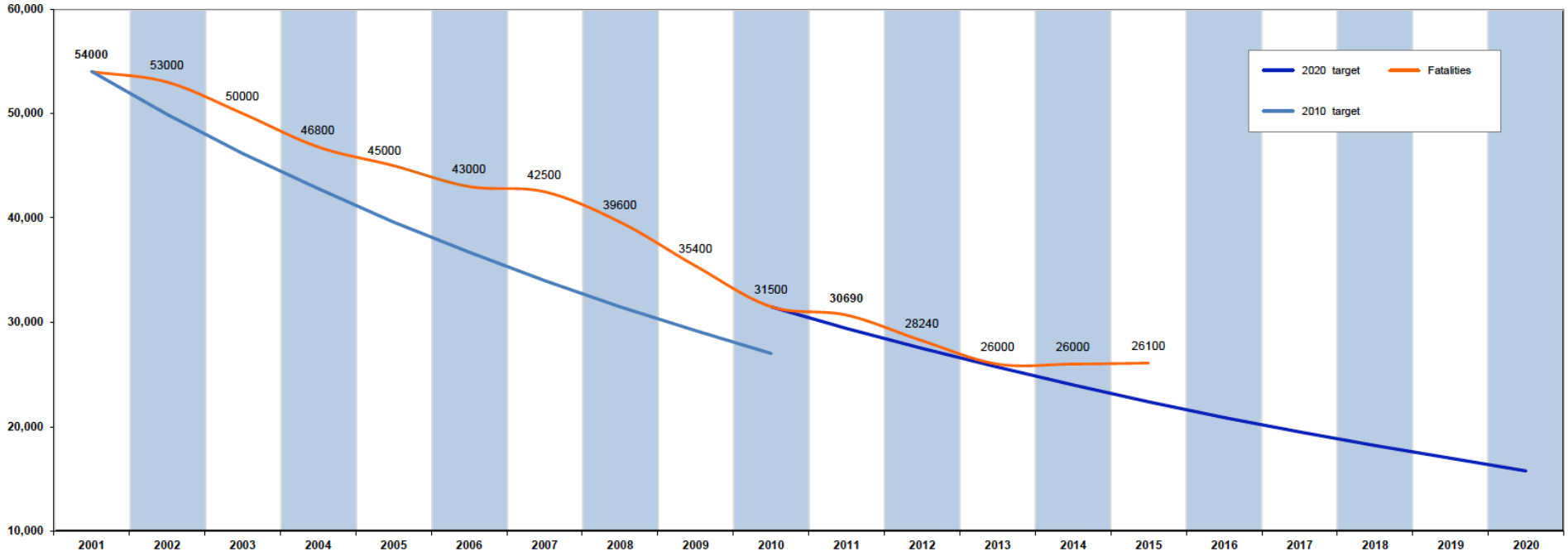
i. *Misure di natura ingegneristica*
ii. *Misure di natura educativa e coercitiva*

5.Laboratorio di sicurezza stradale

i. *Introduzione all'uso dei simulatori di guida*
ii. *Il simulatore di guida come strumento di analisi*
iii. *I simulatori di guida per l'apprendimento*
iv. *Progettazione di un esperimento. Esercitazione pratica presso il Driving Simulator Lab del DICEA*

Road safety in the European Union

Trends, statistics and main challenges (March 2015)



Over time development of number of fatalities and target since 2001

EU situation – The economic point of view

The persistently high number of traffic fatalities (26 100 deaths in the EU in 2015) and serious road traffic injuries is **a major societal problem** causing human suffering and unacceptable economic costs, estimated to be in the order of **EUR 50 billion per year for fatal accidents** alone, and more than EUR 100 billion when serious accidents are included

Valletta declaration on road safety – 29th March 2017

Italian situation

- 2013: **181.227** road accidents with injured people (**3.385** fatalities, **257.421** injured people)

- Average social cost (2010, ISTAT – MIT assessment)
    - **42.219** euro / injured person
- Total cost (2010, ISTAT – MIT assesment): **21,25** BilionEu (1,5%GNP)

- Primary reasons:
    - do not give way
    - distracted driving
    - high speed driving

Road safety in the European Union

Trends, statistics and main challenges (March 2015)

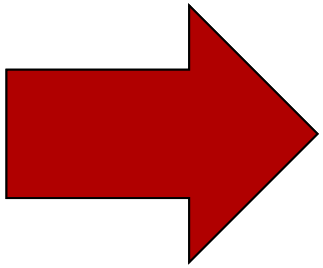
The work we still have ahead is challenging.

- *How can we make the most out of **modern technologies** for safety?*
- *What **innovative ideas** are there for the safety of the most vulnerable road users?*
- *And how to continue mobilising Member States and local stakeholders for the **day-to-day work on the ground**?*

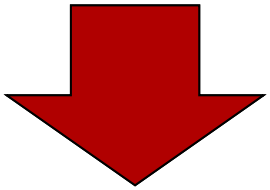
Violeta Bulc
EU Commisioner for Transport

Driver behaviour

Permanent factors
- Personality
- Gender
- Social condition
- Age
- Education
- …..



Risky behaviour



Accident Risk

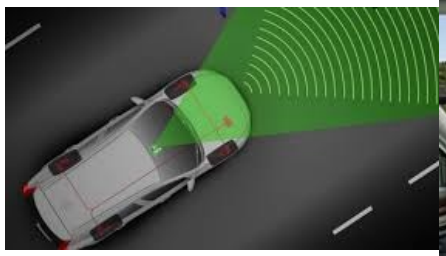
Transient factors
- Time of the day
- Fatigue
- Perceived threat of enforcement
- Stress
- …..

What are the **interventions/actions** we can adopt as **countermeasure** to risky behaviour?

Two classes

Enforcement/Educational

Engineering/Infrastructural



Simulation

What does SIMULATION mean?

Simulation is a surrogate phenomenon that seeks to generate and control both proximal and distal pecpetion-action experiences to create an alternative reality for the esxposed individual.
(Hanckock, 2009)

Why use a driving simulator?..... Advantages

1. Capability of **CONTROLLING** participants experiences
   - Subjects selection (gender, age, etc.)
   - Way and contents of instructions will be given to the subjects
   - Order of presentation of the analysed conditions
   - Activation of events
2. Total **ABSENCE** of **RISK** (possibility of present dangerous driving conditions without being physically at risk)
3. Possibility to make situation, environment and scenarios **REPEATABLE**
4. Availability of a **WIDE RANGE** of **INFORMATION**
   - Vehicle (speed, acceleration, lateral position, steering angle, pedals pressure, etc.)
   - Subject (point of gaze, eye blinking, head position, hearth rate, etc.)
5. **COST-EFFECTIVE** against naturalistic driving

Why use a driving simulator?..... Disadvantages

1. Limited physical, perceptual, and behavioural fidelity

1. Simulator sickness, especially in elderly people or under demanding driving conditions

CALIBRATION
and
VALIDATION !!!!

DSs Main applications

1. Comparative analysis of different **treatments**
2. **Evaluation of new systems and equipment**
3. Analysis of factors **having negative effects on driving**:
   a. Alcohol, drugs, **medications**
   b. **Fatigue**
   c. **Distraction**
4. **Drivers skill evaluation**
5. **Driving learning**

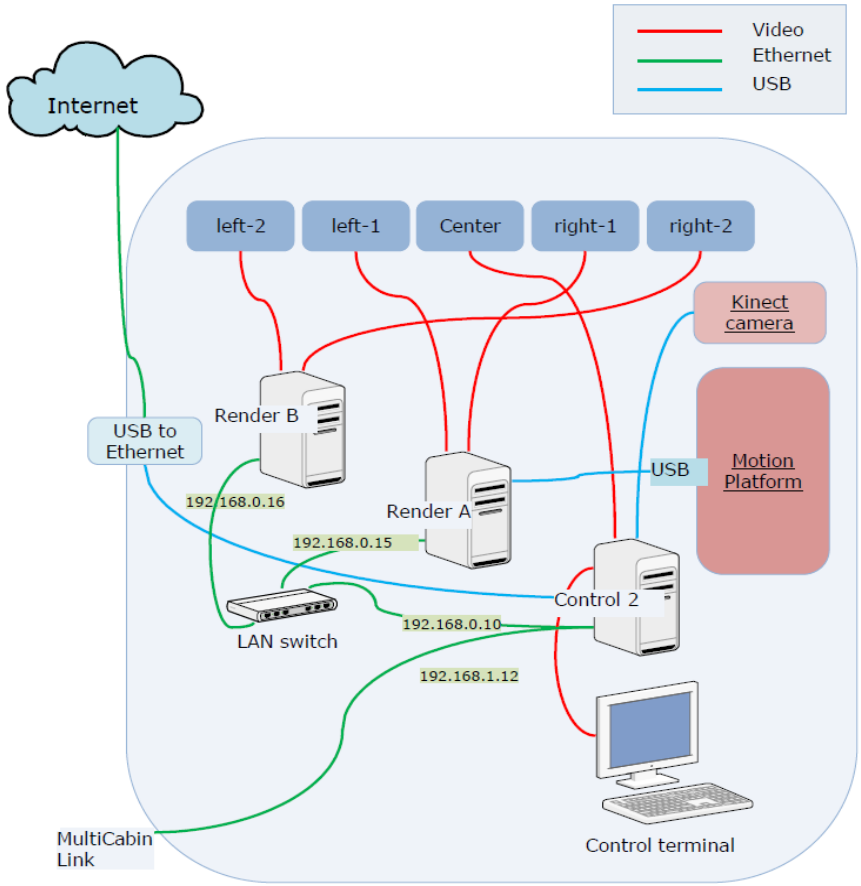
Driving simulators components

- One or more screens displaying highly realistic projected images about road environment (traffic, road surface, signs, surrounding area, etc.)
- Vehicles components (full vehicle or cockpit, seat, pedals, steering wheel, gear shift, rear-view mirrors, etc.)
- A real or virtual dashboard
- Audio system able to play internal and external sounds and noises

DICEA driving simulator

Hardware

System architecture



DICEA driving simulator

Hardware

Components features:

The “physical component” which the driver interact with is made by:

1.aluminum and Plexiglas cockpit provided with a removable panel simulating the car’s roof

2.steering wheel (18 cm radius) provided with force feedback, reproducing vibration and steering rigidity

3.Pedal board provided by brake, clutch and gas

4.light, horn and turn signals levers

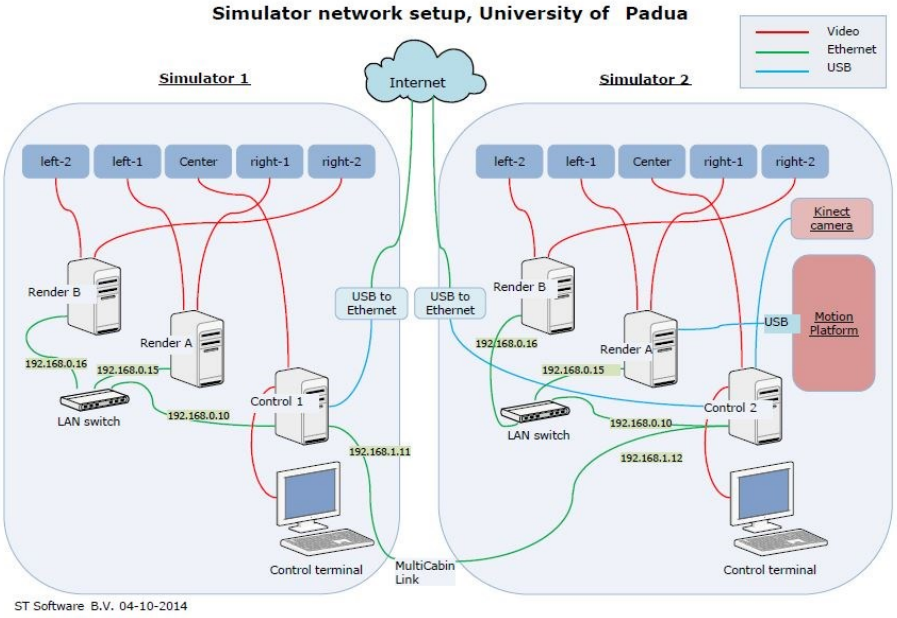
5.manual gearshift (can be set as automatic)

6.manual brake

7.adjustable seat and seatbelt

8.five 60” LCD screens LG

Two interacting DSs system architecture



Driving simulation at DICEA

Collaboration

- Dept. of Developmental and Social Psychology – University of Padova
- Kitami Insitute of Technolgy, Kitami, Japan
- Bar-Ilan University, Ramat Gan, Israel

Driving simulation at DICEA

Focus on:

- Potentially risky situations:
  - Medication effects on drivers (anti-depressant drug)
  - **rough** and damaged **road surface**
  - dangerous driving (forced merging, missed overtaking, **high speed**, etc.)
- Driving behaviour modification over time (**fatigue**)
- **Distraction** (multitasking in driving, e.g. mobile phone use, Advanced Driver Assistance Systems, GPS navigator, etc.)
- Drivers capability assessment (e.g. elderly people) and driver's skill improvement (professional drivers)

FATTORI UMANI NELLA SICUREZZA DEI SISTEMI DI TRASPORTO

Grazie per l'attenzione