Evaluation based on drivers' needs analysis

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Question

• Why do we need e-safety systems?
Driving is an over-demanding, complex, variable and risky activity

- Often pushing human capacities to their limits
  - Leading to human functional failures ("human errors")
  - Sometimes resulting into crashes
  - In Europe, a number of fatalities equivalent to 20 Airbus A320 crashes per month…
Human beings are not so much fitted for driving

A disproportioned speed regarding human physical capacities elaborated through evolution

- Limits to vigilance and attention capacities
- Limits to perceptive ability and motor skills
- An important variety between road users (motivation, attitude, knowledge, ability, etc.)
- …
- But no other system is able to do better than human beings in everyday traffic
Road users in a safe system perspective

A system approach

A question of interactions

An objective of mutual adaptation

An ergonomics perspective
An ergonomics perspective

- A potentially ideal system is not ideal if not adapted to its users and its usage
Implication of ergonomics

- An aid must fit with the effective needs of its users
- It must not be useless for them
- It must not provide additional difficulties
"Human errors" reveal safety needs

- Road accidents are the symptom that Driving is sometimes too much a complex activity for which drivers need an help
- Human functional failures ("errors") reflect drivers' needs
  - What lacked to the driver in order not to be victim of a crash
  - Information, automatism, protection, etc.
- ITS functions are (potentially) a means (among others) to compensate for these drivers' needs
  - If they are adequately defined for the real difficulties met by drivers in crash situations
    - In-depth accident data
    - Human centered model
  - If they are able to fit the constraints found in crash reality
    - (e.g. if the driver is looking behind, a signal on the dashboard is not appropriate…)
Method

- In-depth Accident Data
  - Contextual Parameters
    - Potential Limitations
      - Constraints to Integrate
    - Human Functional Failures
      - Driver's Needs
  - Malfunction Process

- Capacity to compensate for contextual constraints

- Adaptation to drivers' needs

Safety effectiveness
Accidents are sequential processes

- The crash, a terminal event
  - which is built in successive stages
  - which must be analyzed by sequences

- At each stage of the process, different types of needs can be found
- Different safety functions may cover needs at the different phases
Apparatus

- **Catalogue of safety functions**
  - The most dedicated to safety
    - DaCoTa Deliverable D 5.2.3 : 21 Safety functions
      - E.g. "Blind Spot Detection", "Electronic Stability Control"…
    - + infrastructure based safety functions
      - E.g. "Rumble Strips", "Intersection Alert" ...

- **445 in-depth accident cases**
  - Including two-wheelers and pedestrians
  - Case by case analysis
  - A time consuming but fruitful activity
    - Human failures and their factors
    - Drivers needs at the different phases
    - Adaptation of safety functions to drivers needs
    - Potential limits of efficiency
Hints of results

• Not to be considered in an overall way
• Differences in the capacity of safety functions to meet drivers needs according to:
  – The accident configuration (single vehicle / interaction with traffic)
  – The moment of the accident process (approach / rupture / emergency)
  – The road users involved (Car drivers / PTW riders / pedestrians)
• For example, for car drivers in interaction accidents
  – Approach phase
    • Intersection Control (30%), Intelligent Speed Adaptation (15%), Traffic Signal Recognition (14%)
  – Rupture phase
    • Collision Avoidance (29%), Intersection control (24 %), Intersection alert (15%)
  – Emergency phase
    • Collision Avoidance (40 %), Predictive Brake assist (19%)
Hints of results

- **Potential limitations to safety functions efficiency**
  - Linked to the driver
    - Counter motivations, Low vigilance, Distracted driving, etc.
  - Linked to external context
    - Situational constraints, Safety functions specifications, etc.

<table>
<thead>
<tr>
<th>Potential limitations</th>
<th>Car drivers</th>
<th>PTW riders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linked to driver's state and motivation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inattention, thoughts, concerns</td>
<td>9,0%</td>
<td>3,4%</td>
</tr>
<tr>
<td>Passive distraction (e.g. scenery)</td>
<td>7,5%</td>
<td>1,7%</td>
</tr>
<tr>
<td>Active Distraction</td>
<td>5,0%</td>
<td>1,7%</td>
</tr>
<tr>
<td>Deliberate violation</td>
<td>2,7%</td>
<td>8,6%</td>
</tr>
<tr>
<td>Linked to contextual constraints</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced time / space condition</td>
<td>8,6%</td>
<td>17,2%</td>
</tr>
<tr>
<td>Insufficient width of radar</td>
<td>6,9%</td>
<td>4,3%</td>
</tr>
<tr>
<td>Visibility impaired by a vehicle</td>
<td>5,5%</td>
<td>5,2%</td>
</tr>
<tr>
<td>Assistance trigger threshold</td>
<td>2,5%</td>
<td>5,2%</td>
</tr>
</tbody>
</table>
Conclusion

• A specific contribution to evaluation of safety functions efficiency
  – Directed toward road user's needs
• A methodology taking into account:
  – Human difficulties (functional failures)
  – Accident reality (context parameters)
• Allow defining:
  – Safety needs for different kinds of drivers, reflecting their accident-generating failures at the different stage of the process
  – The potential capacity of safety functions to meet these needs
  – The potential lacks in the functions efficiency
  – The conditions for improving their effectiveness

➢ Purpose is not to guess what the future will be
➢ But to define the conditions under which it could be better
Thanks you

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