Improvement of cyclists’ conspicuity in urban environment using safety messages for car drivers

C. Gasne*, A. Lafont**, C. Jallais*, D. Ndiaye*

*LESCOT UGE  **Altran Lab Capgemini

TD. Nguyen, F. Vienne, PICS-L UGE

JM Boucheix, LEAD CNRS-Université de Bourgogne
Low conspicuity of the vulnerable road users (VRUs) for motorists
=> high risk of accident or near misses

**Sensory Conspicuity**
varies according to the physical characteristic of VRUs (retinal angular size, position in the motorist visual field, colour and luminance contrast with the background …)

Cole 1988, Rogé 2019

**Cognitive conspicuity**
Varies with specific characteristics of car drivers (their experience, their expectations, their temporary intentions …)

Langham 2002, Rogé 2017
Effect of a preventive film on pedestrians and motorcyclists’ visibility

Film: preventive messages, testimonies and statistical data analysis (VRUs)

Task: detection of pedestrians and motorcyclists in a simulated road environment

Variable: preventive film “watched or not watched” before driving

Results

- Increase of the VRU visibility distance
- Increase of the negative emotions’ intensity

⇒ Positive effect of the film / pedestrians and motorcyclists visibility
⇒ Implication of emotions?
Persuasive techniques used in road safety campaigns

300 campaigns (41 countries) for the adoption of safety measures

* Rationale: scientific explanations → cognitive satisfaction
* Humour: entertaining message → capture interest, facility memorization
* Social and ethical values: empathy → increase the positive feelings and the social standards
* Threat use: horror of crash → indignation, anger, shame, guilt

!!! If the intensity of emotions too high => reactance response (rejection and distancing)
Percentage of the preventive films related to cyclist safety by country (45 available on internet 2018)

Percentage of the preventive films related to cyclist safety by communication mode

* Heterogeneity of the preventive films: communication mode, duration, topic, and making of the films

=> Create original messages in order to compare their effect

* Messages aimed at motorists, interactions between motorists and cyclists

- Safe distance
- Excessive speed
- Door opening
- Right-turn situation
- Cell Phone use
Common features of preventive films

- Making of the films: overlay of a real driver and car in a simulated environment
- A final short preventive sentence identical for the 2 communication modes
- Duration: 31s

<table>
<thead>
<tr>
<th>Emotional films</th>
<th>Educational films</th>
<th>Neutral films</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic images</td>
<td>Static images</td>
<td>Dynamic images</td>
</tr>
<tr>
<td>Injured cyclist</td>
<td>Injured cyclist</td>
<td>Cyclist</td>
</tr>
<tr>
<td>The inevitability of the crash</td>
<td>Practical guidance if possible</td>
<td>Images from nature</td>
</tr>
</tbody>
</table>
Objective: Study the effect of the short films watched before driving on car drivers

Hypothesis

H1 Car drivers will estimate the emotional films more effective than the educational ones

H2 The preventive films will help the car drivers to detect the cyclists during driving, particularly the emotional ones

Population

57 men (25.4 years old), driving license (6.4 years)
Randomised in 3 groups (19)
Each participant watched 5 films belonging to a specific category (educational or emotional or neutral one)
Course of the experiment

Recall task

Questionnaires

Driving

Experimental design

ΔHbO dans le cortex préfrontal

Mood Box

Driving
The emotional wheel

Mean of intensity
- for the positive emotions (8)
- for the negative emotions (8)
Emotion intensity as a function of the communication mode and the valence of emotions

Mean of intensity
- for the positive emotions (8)
- for the negative emotions (8)

Non parametric tests
57 participants (3 groups)

==> Ability to self-assess and to report the emotions felt during the films watching

No significant effect of the communication mode on the positive emotion intensity

Negative emotions intensity varies according to the communication mode
Significant effect of the topic

Significant effect of the communication mode

ANOVA: Communication mode$^2$, Topic$^5$

38 participants (2 groups)
Fixed base simulator

Front view: 9 screens (back screen projection)

Back view
  - Inside mirror (front screen projection)
  - Exterior mirrors (2 screens of 7 pouces)
Simulated urban environment

Area = 6 km²

Instructions
- reach a specific location
- comply with traffic laws
- detect VRUs (pedestrians and cyclists)
31 cyclists

51 pedestrians

other vehicles (cars, vans, buses, trucks)
Distractors

Slow vehicles

VRUs detection task
VRUs detection

ANOvas: Communication mode\(^3\), VRU type\(^2\)

57 participants

Interaction of VRU type and communication mode

\[
\begin{align*}
\% \text{ of detected pedestrians} & \\
\% \text{ of detected cyclists} & \\
\end{align*}
\]

==> Cyclists’ cognitive conspicuity enhanced by preventive films

Pedestrians and motorcyclists (Rogé 2015) = Cyclists (Lafont 2021)

==> Information about critical situations involving cyclists and car drivers is more important than the communication mode of the preventive message
Assessed efficiency of the preventive films

- Emotional films > Educational films

Percentage of detected cyclists

- Emotional films = Educational films

Declarative data:

Indicator: real efficiency of the preventive messages?

Advantages of advanced simulators to evaluate the impact of preventive messages

- critical situations without taking risks
- collection of objective data (VRUs detection)

High realism level!
Simulator sickness!

And after .....

Conspicuity of e-scooter users for car drivers

Immersive Virtual Reality technique to improve the visibility of the e-scooter
Thank you for your attention