

# Review of distracted driving factors



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*George Yannis, Associate Professor, NTUA*  
[www.nrso.ntua.gr/geyannis](http://www.nrso.ntua.gr/geyannis)

# Research Objectives – Presentation Structure

## Research Objectives

- To provide a comprehensive picture of the impact of driver distraction to road safety.
- Both internal and external distraction factors are considered.

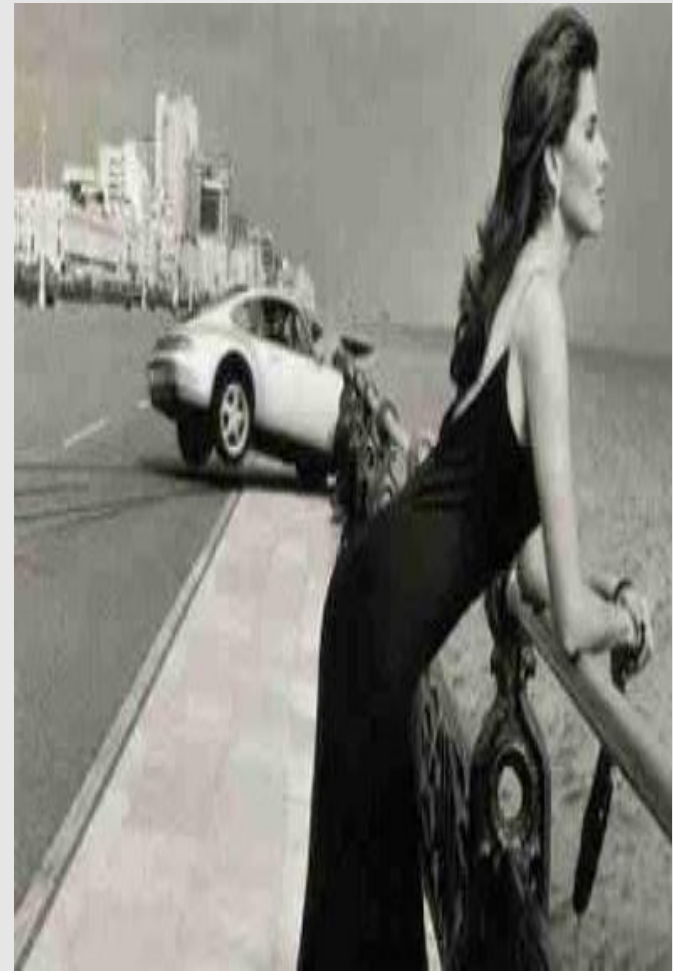
## Presentation Structure

- Review of international literature & results synthesis.
- Proposals for countermeasures.



# Basic Questions on Distracted Driving

- What is distracted driving?
- How critical risk factor is distracted driving?
- Which are the in-vehicle distraction factors?
- Which are the external distraction factors?
- What is the effect of distracted driving
  - to driver attention?
  - to traffic behaviour?
  - to accident risk?
- Can distracted driving be prevented?



# Road Accident Contributory Factors – Human Factors

- Human factors are the basic causes of road accident in 65-95% of road accidents.
- Human factors include a large number of specific factors that may be considered as accident causes, including:
  - driver injudicious action (speeding, traffic violations etc.);
  - driver error or reaction (loss of control, failure to keep safe distances, sudden braking etc.);
  - behaviour or inexperience (aggressive driving, nervousness, uncertainty etc.);
  - Driver distraction or impairment (alcohol, fatigue, mobile phone use etc.).



# Road Accident Contributory Factors - Impairment or Distraction

Road accident contributory factors	Fatal accidents (%)	Total accidents (%)
Road environment	9	16
Vehicle defects	3	2
Injudicious action	29	25
Driver/rider error	64	68
<b>Impairment or distraction</b>	<b>22</b>	<b>12</b>
Alcohol	11	5
Drugs	3	1
Fatigue	3	1
Illness or disability	5	1
Mobile phone use	1	0
In-vehicle distraction	3	2
External distraction	2	1
<b>Behaviour or inexperience</b>	<b>27</b>	<b>24</b>
<b>Vision affected</b>	<b>7</b>	<b>10</b>
<b>Pedestrian accident</b>	<b>19</b>	<b>13</b>

Impairment or distraction factors account totally for 12% of all contributory factors

Internal distraction factors account for 2/3 of the total distraction factors

# Driver Distraction Factors

In-vehicle	External
Passengers	Traffic control
Communication devices	Other vehicle
Entertainment system	Looking for destination / location
Vehicle systems	Pedestrian / Bicyclist
Eating / drinking	Accident / incident outside the vehicle
Smoking	Police / Fire brigade / Ambulance
Animal / insect in the vehicle	Landscape / Buildings
Coughing / sneezing	Animal
Driver stress	Advertising sign
Daydreaming	Road signs and markings
	Sun / vehicle lights

# Driver Distraction Impacts

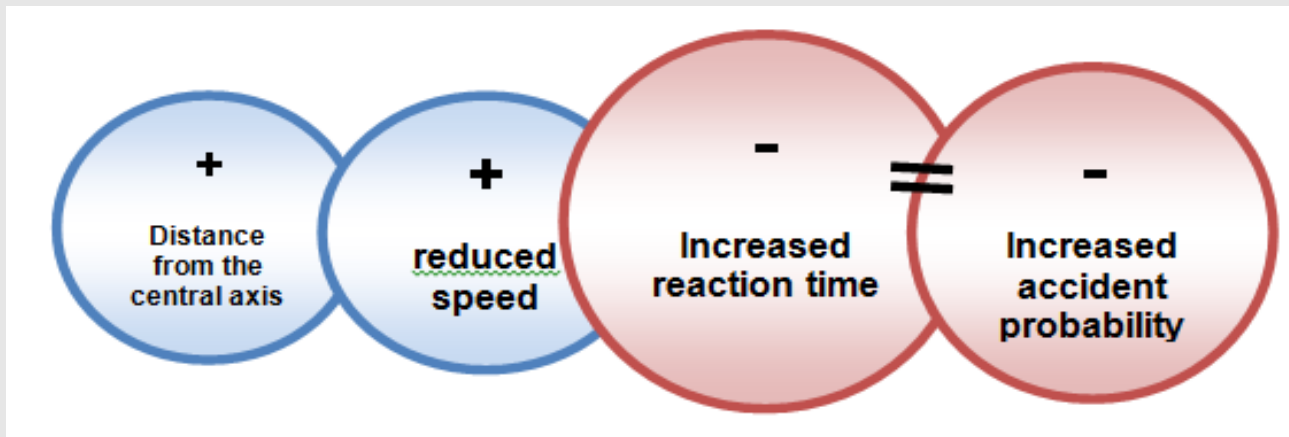
➤ Driver distraction may have an impact to:

- Driver attention;
  - Hands-off the wheel;
  - Eyes-off the road.
- Driver behaviour;
  - vehicle speed;
  - headway;
  - vehicle lateral position;
  - driver reaction time.
- Driver accident risk.



# Distraction accident risk – Mechanism

- The decrease in speed and the increase in the distance from the central axis, during distracted driving might be considered beneficial for road safety.
- However, they cannot always counter-balance the driver's distraction.
- This leads to increased reaction times, and eventually increased accident probability, especially at unexpected incidents.





# Influence of In-vehicle Distraction Factors

Type of Secondary Task	Odds Ratio*
<b>Reaching for a moving object</b>	<b>8.82</b>
Insect in vehicle	6.37
<b>Reading</b>	<b>3.38</b>
<b>Applying makeup</b>	<b>3.13</b>
<b>Dialling hand-held device</b>	<b>2.79</b>
Inserting/retrieving CD	2.25
Eating	1.57
Reaching for non-moving object	1.38
Talking/listening to a handle-held device	1.29
Drinking from open container	1.03
Other personal hygiene	0.70
Adjusting the radio	0.50
<b>Passenger in adjacent seat</b>	<b>0.50</b>
Passenger in rear seat	0.39
Child in rear seat	0.33

\* Only factors in bold are statistically significant

Reaching for a moving object is the most risky behaviour observed, increasing crash risk by more than eight times that of just driving.

# In-vehicle distraction – Mobile phone use

- Earlier and recent studies agree that mobile phone use while driving may **significantly affect** driver's behaviour and safety.
- Research results suggest that mobile phone use may be the most important in-vehicle distraction source for drivers.
- Drivers **tend to reduce their speed** during a mobile phone conversation.
- Although reduced speed is generally associated with lower accident risk, drivers using their mobile phone while driving present up to **4 times higher accident risk**, most probably as a result of increased workload and delayed reaction time.



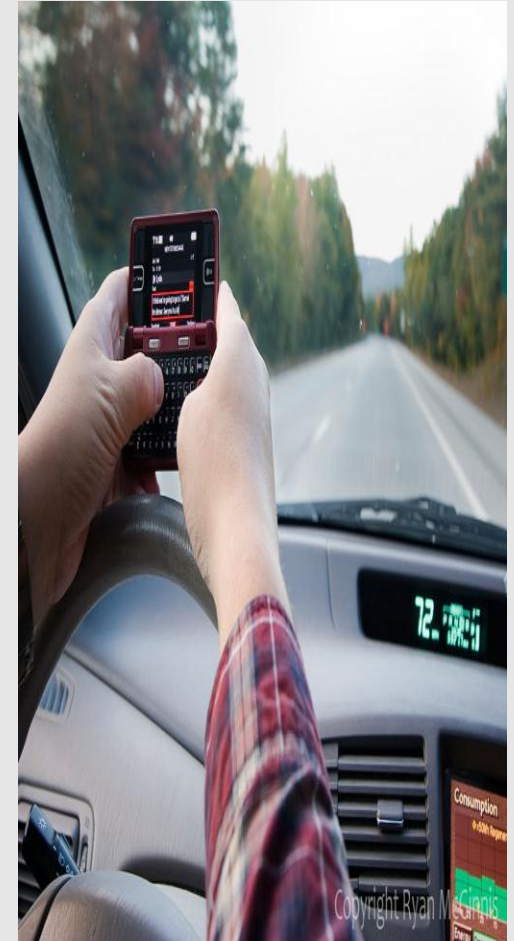
# In-vehicle distraction – Mobile phone use – handheld vs. hands-free

- Although the physical distraction associated with handling the phone can present a significant safety hazard, the **cognitive distraction** associated with being engaged in a conversation can also have a considerable effect on driving.
- Many studies have found that conversing on a hands-free phone while driving is **no safer** than using a hand-held phone.
- When drivers were engaged in a phone conversation using either a hand-held or hands-free phone, they demonstrated similar driving deficits.
- Drivers tend to **overestimate the ease of using hands-free** phones while driving.



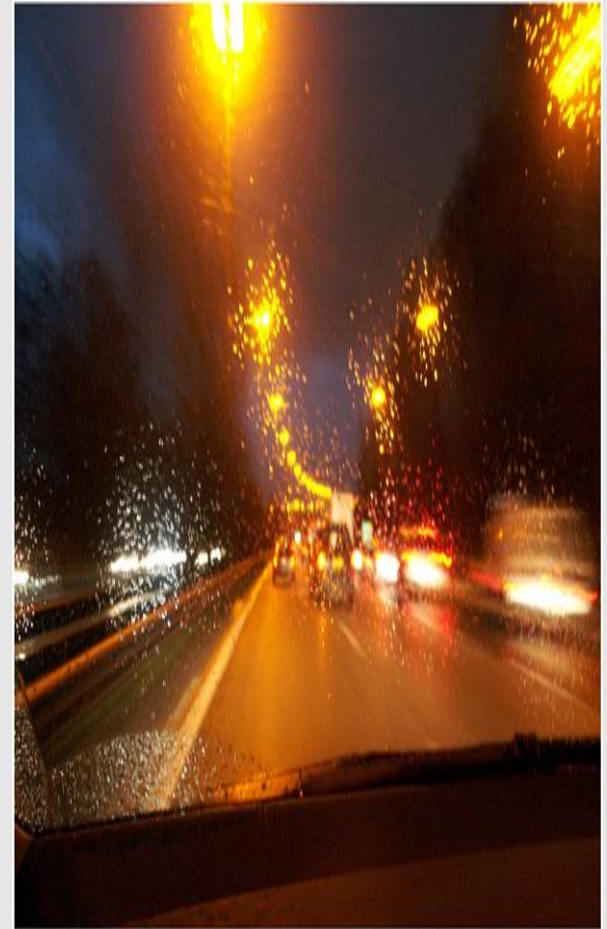
# In-vehicle distraction – Mobile phone use: texting

- Important distinction: texting is amenable to resumption after selective disengagement, while conversation may be more difficult to interrupt and resume, once initiated.
- The question of whether drivers actually modulate texting engagement is not well addressed in the literature.
- Results indicated that drivers were particularly **impaired when sending text messages and less so when receiving.**
- When texting, participants express greater following variability, greater lateral variability, reduced response time to the lead vehicle, and increase in collision frequency.
- A recent naturalistic driving experiment suggests that the effects of texting may be significantly underestimated in previous (*simulator*) experiments.



# In-vehicle distraction – Mobile phone and other factors

- Driving environment: Impairment due to mobile phone use may increase **in more complex road environments** (e.g. urban areas, unfamiliar environment), more traffic density, adverse weather conditions.
- Driver age: Research has consistently found that **older people have a decreased ability** to share attention between two concurrent tasks while driving than younger drivers.
- Driving experience: **Young novice** drivers may also be relatively **more vulnerable** to the effects of distraction than experienced drivers.



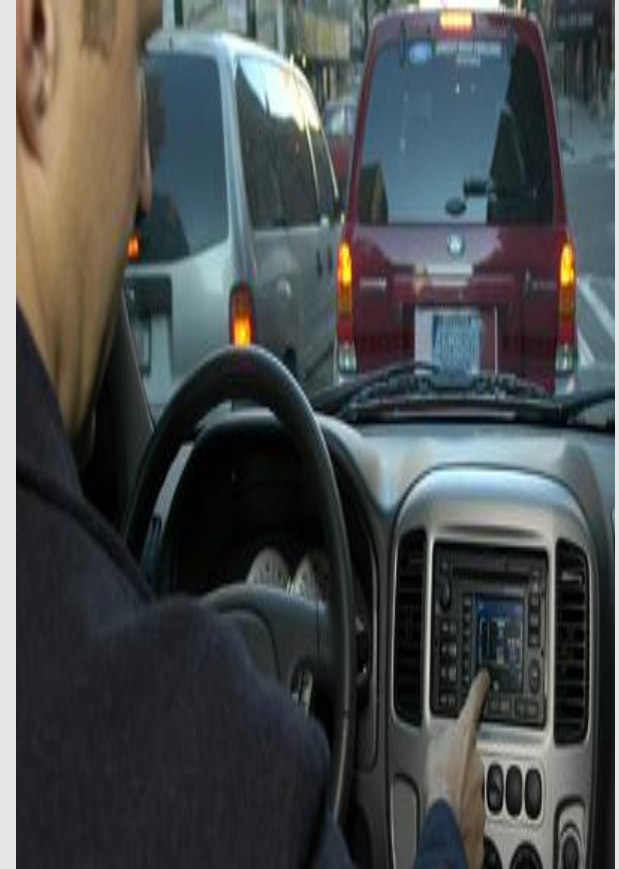
# In-vehicle distraction – Mobile phone use - Other issues

- **Complex conversation** is associated with more impaired driving, due to higher cognitive demands.
- In naturalistic conversation experiments, however, the differences between simple and complex conversation were less striking than in simulator experiments.
- **Repeated experience may lead to learning effects.**  
Over the course of repeated sessions, the negative effects of the phone tasks on driving performance may diminish.



# In-vehicle distraction – Entertainment systems

- Few studies have specifically studied the distracting effects of operating vehicle radios or other entertainment systems.
- Turning on or simply listening to the radio while driving can distract a driver and degrade driving performance.
- Research has also suggested that **operating** a CD player while driving may be equally distracting to dialling a mobile phone.



# In-vehicle distraction – Navigation systems

- In-vehicle route-guidance, navigation systems (e.g., GPS) or other ADAS are designed to assist drivers, but have the potential to distract drivers in several ways.
- **Entering the destination** into the navigation system is considered the most distracting component of using in-vehicle navigation systems.
- **Voice activated systems are not proved to be safer** in terms of distraction, as they result in increased eye-glances.





# In-vehicle distraction – Conversation with passengers

- The frequency of driver distraction from conversation with the passengers may be almost equal to the frequency of distraction by the use of mobile phone.
- The results of the 100-car naturalistic driving study revealed that a driver-passenger interaction was observed in 20% of accident, near-misses and incidents recorded.
- Effects may depend on the nature of the conversation (“simple” vs. “complex” conversation).
- **A more demanding conversation is associated with increased accident risk.**
- Comparison phone conversation vs. passenger conversation suggests that **phone conversation is more cognitively demanding.**



# In-vehicle distraction – Eating, drinking

- Around half of all drivers in the USA admit that they are systematically eating or drinking while driving at around one third of their trips.
- 4.2% of distraction related accidents in the US are due to eating or drinking.
- Respective related results from New Zealand range at around 3%.
- Eating and drinking increased the **hands-off-the-wheel time** while driving and contributed to a difficulty in keeping vehicle lateral position.
- Simulator experiments show **little effect of eating or drinking** on driver behaviour and safety.



# In-vehicle distraction – Smoking

- On the basis of the CDS -Crashworthiness Data System, 1% of accidents are due to driver smoking.
- The 100-car naturalistic driving study associated 2% of distraction or inattention related accidents with smoking.
- 2.2% of accidents in New Zealand are due to smoking-related distraction. Furthermore, about half of these accidents took place while reaching out for a cigarette, another one fourth while lighting a cigarette and another one fourth while searching for a dropped cigarette.
- Simulator experiments found **no effect of smoking** on accident probability.



# External distraction – Advertising signs, billboards etc.

- Most studies agree that advertising signs **do attract the attention** of the majority of drivers, for a non negligible proportion of their driving time.
- Research on labels and advertising signs is **not conclusive** so far as regards their impact on **accident risk**.
- The **location and position** of labels and advertising signs might have different impact to the distraction of driver attention.
- Labels and advertising signs resembling (in size and form) to traffic signs or other traffic indicators create confusion.
- **Blinking and animation objects** have proven to be difficult-to ignore, dynamically changing advertising and information are ill-advise.



# Pedestrians distraction

- The degree to which handheld multimedia devices may distract pedestrians, especially young people, is increasingly examined in the literature.
- Recent findings from observational research suggest pedestrians who are distracted by phone conversations or other activities take **greater risks when road crossing**.
- Pedestrians who **listened to music or texted** while crossing the street experienced more hits by vehicles in a virtual pedestrian environment than pedestrians who were not distracted.
- The use of **hands-free devices is not associated with reduced risk**.



# Measures against driver distraction - Driver

## ➤ Enforcement of traffic rules

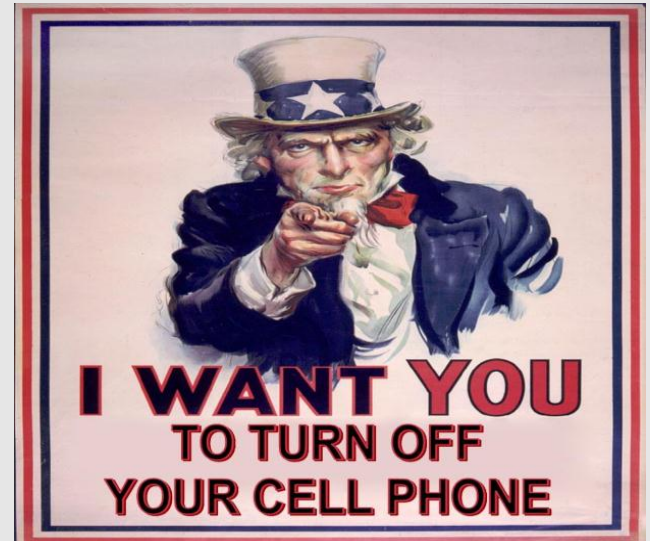
- not use of mobile phones;
- position and characteristics of signs.

## ➤ Driver awareness campaigns

- risk associated to mobile phone use;
- risk associated to driver distraction in general.

## ➤ Driver training and education

- traffic education at school;
- for novice drivers;
- for all drivers;
- re-integration courses of frequent offenders.



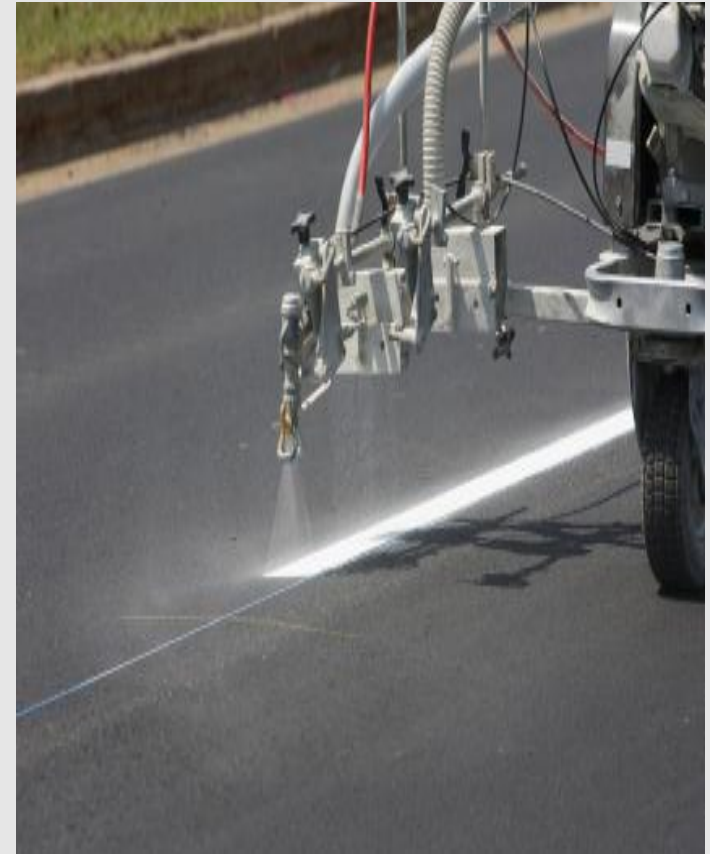
# Measures against driver distraction - Technology

- **Steering mounted buttons** systems to input information;
- Systems which rely on **voice activation** for input.
- Tactile marks on the phone key pad buttons to give each button a distinct feel, reducing the need for drivers to look away from the road;
- Negative impacts on safety of voice-activated systems have been identified, and the potential safety impact of other systems are unknown.
- **Blocking phone calls while driving** is a rapidly developing technology, but currently not supported by all phone types.
- More **ergonomic design of the human-machine interface** of in-car information systems to allow safe use. The current trend of miniaturisation of mobile phones may lead to safety problems.



# Measures against driver distraction - Roadway

- There are **no roadway countermeasures directed specifically at distracted drivers.**
- Many effective roadway design and operation practices that improve traffic safety in general, such as edge line and centreline rumble strips, can warn distracted drivers or can mitigate the consequences of distracted driving.
- **Creation of less demanding traffic conditions**
  - interventions on infrastructure;
  - interventions on traffic management.





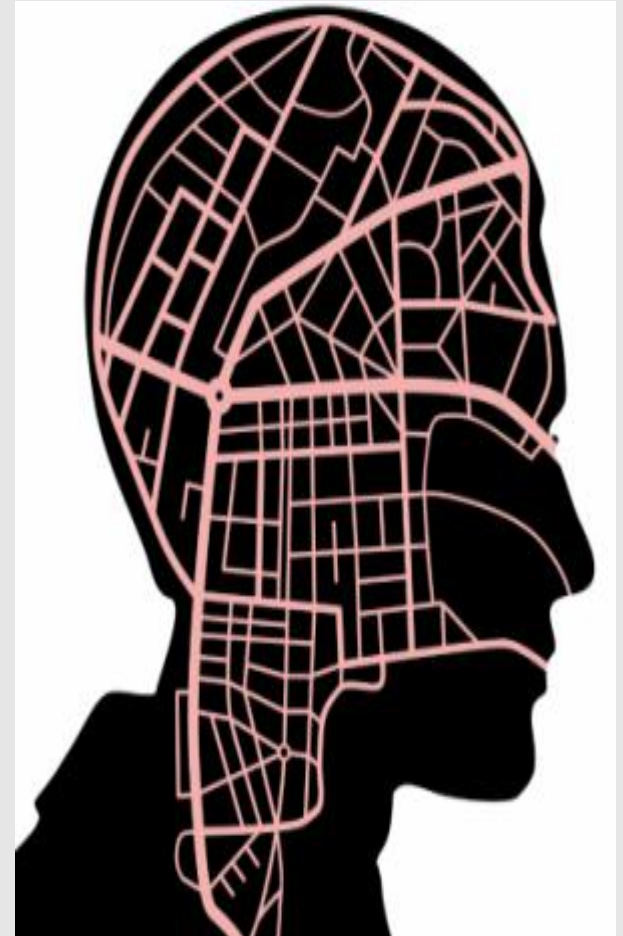
# Distracted Driving - Future Research

- identify functions behind distraction activities;
- focus on mobile phones use;
- separate impact from the various distraction factors;
- examine the combined effect of all distraction factors;
- **link distraction-associated driver behaviour with accident risk;**
- cross validation through experiments (driving simulator, naturalistic driving) and epidemiological studies;
- ergonomic design of devices to minimise distraction;
- develop universally agreed definition of driver distraction.



# Distracted Driving - Future Challenges

- **Research on remedial measures** should concern separately visual, auditory, manual and cognitive distraction.
- Legislation for compulsory **improved human-machine interfaces** at both the vehicle and the mobile phone industries should not be delayed.
- **Drivers should learn to manage distraction:**
  - avoid risky behaviour (texting, handheld phones, distraction overload);
  - interrupt the discussion when there is driving overload (either discussion with passengers or through mobile phone);
  - stop the vehicle if it is necessary to continue the discussion;
  - learn to use hands-free devices.



# Review of distracted driving factors

## Apoio



## Patrocinadores

