Driver distraction: an unperceived risk

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"Driving is one of the most demanding tasks we do, yet a lot of drivers treat it as a secondary activity. Unless we always give the driving task our top priority, we're bound to have a mishap sooner of later - and it could be a serious one."

Canada Safety Council, 2002

"Por la raja de tu falda, yo tuve un piñazo con un SEAT Panda"

"The split in your skirt made me crash into a Seat Panda"

Estopa, Spanish pop duet, 1999

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"When you're in the car there is also the luggage, the kids, the mother-in-law; it is a distracting atmosphere. And we often get into the car being tired, which is something that might be as serious as having had a drink."

Pedro Martínez de la Rosa, Formula 1 driver

In recent years, we have been witness to a significant improvement of the road safety levels in the European Union, and particularly in Spain. The reasons for this phenomenon are well known: major investments in infrastructures that have lead to an improvement of the road quality; a considerable effort of manufacturers, strengthening the features offered by cars, both as regards passive and active safety; and last but not least, a substantial change in the behaviour of drivers, who have evolved to patterns of higher responsibility.

All of this has been favoured by a more and more demanding regulatory environment, in which administrations have applied a carrot and stick policy, going from implementing the points-based driving license or the reform of the Penal Code to carrying out large awareness and prevention campaigns, which was not easy at all.

From among all recorded changes, the most outstanding, because it is surprising, is the improvement of the driver behaviour. Particularly in Spain, we have been able to observe a major advance in a short period of time, both as regards the increased use of the safety-belt by drivers and helmets by riders, as well as a significant improvement as regards speeding, and also a much more prudent attitude as regards the alcohol/driving pairing.

It is curious, however, that distractions, despite being the main concurrent factor in road accidents in our country, have been left aside of the main focus of attention of public opinion and road safety policies. It may be because it is a much more hazy reason for an accident and therefore much more difficult to deal with, that the Road Traffic Directorate and the Catalan Traffic Authority have started to attach importance to this question not long ago. And yet, there is still a lot of work to do if we really want to reduce the incidence of distractions on road accidents.

This report is intended to help to accelerate this process. To do so, we pursued three objectives during its preparation: first, to offer a rigorous vision of the phenomenon of distractions, based on a review of the most relevant academic literature; second, to do pedagogy and to try to shed light on the black hole which distractions still represent, using a structure and language that would be attractive for the large public; third to spread the message based on the experiences of six of the most relevant active Spanish drivers and riders: Carlos Sainz and Dani Sordo, from the world of rallying; Pedro Martínez de la Rosa and Marc Gené, from Formula 1; and Dani Pedrosa and Jorge Lorenzo, from motorbike racing.

The report we are presenting herewith is thus the central piece of a larger project about driving distractions which the RACC Foundation has been developing for some time now, and which is complemented by two additional important contributions: On the one hand, there is a video with simulations, which intends to raise the awareness of drivers about the serious consequences that distractions may have, with the largest possible realism; and on the other, a further video with the contributions of the six aforementioned drivers and riders, explaining their experiences to manage distractions, i.e. to try to avoid them, while driving.

We hope that reading this report and watching the videos will be of interest, not only to experts on road safety, but also to public opinion in general. And we hope, above all, that this work will help to increase the awareness level of drivers as regards the danger implied in distractions, since this is, in short, the most important conclusion arising out of this report: distractions are an unperceived risk factor, the effects of which can only be relieved appropriately with a prevention strategy, including a great deal of common sense. Nothing more and nothing less.

Chapter 1

Distraction as a road safety problem

"People do not attach much importance to distractions yet. I've been driving along with other motorists and I've seen how they almost crashed but they didn't even notice."

Dani Pedrosa, motorbike rider

1.1 Introduction

Driving is a complex activity in which you need to constantly perceive the changing traffic situation, assess it, decide the most appropriate actions to take in each case, and apply all of these actions correctly. All of these processes need the driver to be in perfect psychophysical conditions in order to carry them out suitably.

The complexity of driving a vehicle is highlighted during the first times we try to do it. It is difficult to be aware, amongst many other things, of traffic signs, vehicles driving ahead and behind your vehicle, pedestrians crossing the street, the vehicles' control panel (speedometer, rev counter, etc.) and at the same time choose the right gear, the speed and the appropriate manoeuvres to travel on public roads. With practice, some of these tasks become automatic, and driving a vehicle becomes almost a routine; so much that we even feel capable of driving and carrying out other activities that also need our attention [1].

If you are a driver, think about how many times you have carried out a secondary activity while you were driving your car. For instance, how many times do you tune to a certain radio station or introduce a CD in the car audio system while holding the steering wheel with only one hand? How often do you use the mobile telephone while you are driving? Do you usually re-programme your navigation device without actually stopping the car? When you are not alone in the car, do you usually start a conversation with the passenger or passengers? If your passengers are children or pets, do you look after them while you are driving?

These are only a few examples of activities that many drivers carry out while they are driving and that may distract them from the main activity they are carrying out at that moment: travelling on a public road. The main or concurrent cause of many road accidents is the distraction of drivers and a large part of these distractions happen because the driver cannot deal with the demands of the traffic situation, since part of his attention is focussed on another activity which has nothing to do with driving.

In Spain, according to data from the Traffic Authorities, distractions were a concurring factor in one of every three accidents in 2006, meaning that almost 1,100 people died in road accidents related to some kind of distracting factor. In order to fully assess the incidence of distractions, we would have to add these figures to the countless smaller accidents happening every day on our roads and in our cities, which are impossible to record in the statistics of the traffic authorities.

Distractions are thus a risk factor of the first order, although it is often not perceived as such by the driver.

1.2 Definition of distraction

The Dictionary of the Royal Spanish Academy [2] defines distraction as "something attracting the attention, turning it away from what it is being applied to and, especially, a show or a game that serves to get some rest". The first part of this definition coincides to a large extent with what is going to be proposed in this document.

To be precise, the National Highway Traffic Safety Administration (NHTSA) [3] makes a difference between inattention and distraction when driving a car. Causes of inattention are:

1. When the driver carries out a secondary activity while driving, in such a way that his attention is turned away from the task of driving (e.g. talking on the mobile telephone or watching a hoarding).

2. Carrying out activities and manoeuvres directly related to driving the vehicle that turn away the attention of the driver from the road (e.g. looking in the rear-view mirror or at the instructions of the navigation device).

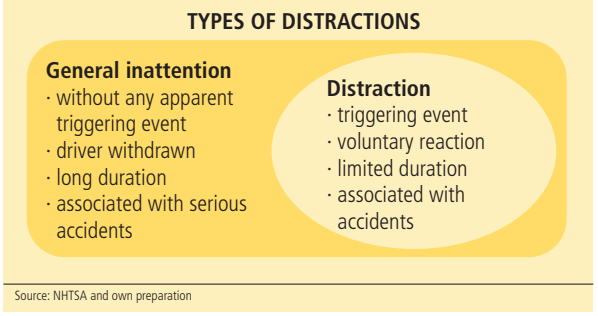
3. Drowsiness or sleepiness of the driver.

4. Any circumstance that turns the attention of the driver away from the task of driving.

Although, to a higher or lower degree, all previously mentioned causes of inattention can put drivers at risk, in this document, we will only focus on activities carried out voluntarily by a driver while driving a vehicle and which are not related to the driving task as such, which we will call distractions.

A driving distraction occurs when any event, activity, object or person, inside or outside the vehicle, gets the attention of the driver, who turns it away from the driving task [4, 5, 6]. A wasp inside the vehicle, two children fighting in the back seat, a call on the mobile telephone or a dead dog in the ditch are examples of stimuli that can distract the driver and consequently, cause an accident.

Chart 1. Inattention and distraction



Source: NHTSA and own preparation

There is always an event that triggers off distractions, thus it is possible to make a difference between distraction and lack of attention or absorption of the driver, which are situations in which this does not happen [4, 5].

In most of the cases, driving distractions do not have serious consequences because they do not coincide with complicated traffic situations. But if there is a problem, since the driver is not alert enough as regards driving or what is happening on the road, he will probably not have time enough to plan and carry out the appropriate manoeuvre [4, 5] and be unable to avoid a collision or an accident. The higher the speed of the vehicle, the less margin of reaction there is in the face of contingencies and the more convenient it is to be completely focussed on driving and to try to avoid any possible distraction.

If distractions have always a triggering factor, this can generally occur in three different situations:

1. Those cases in which it is the driver him/herself who voluntarily causes the distraction, stopping to pay attention to what is happening on the road. For instance, he/she "gets distracted" looking for a CD and puts it in the CD-player, re-programming his/her navigation device or lighting a cigarette he/she is holding in his/her hands while he/she is driving.

2. In other cases, we should rather say that the driver "is distracted" and even if he/she might ignore the surrounding demands (a mobile telephone ringing, a passenger talking, etc.) he/she usually reacts, either because the sound of the telephone is annoying, in the first case, or as a courtesy in the second.

3. Last but not least, we can talk about the "withdrawn" driver, who does not pay attention to driving because, without even noticing it, he/she started thinking about something that captured his/her interest. As we can see, in this case - which is not considered as a distraction as such - the lack of attention is involuntary and the driver will hardly be aware about the risk he/she is taking while driving in these conditions.

In this document, we are referring to those drivers who get distracted and are distracted voluntarily. And we should not forget all those distracters that are generated in the driver him/herself, such as physical discomfort or pain [4], as well as intentional thoughts [6], like for example going through the agenda of the day while driving to work. These factors have not been sufficiently investigated yet; possibly due to methodological difficulties to record data, although they are starting to get more attention in recent times.

Alternately we will not consider as distracters certain situations in which drivers feel bored, impatient, in a hurry, tired, sleepy, etc. or in which they feel anxious, sad, badly-tempered or angry, among many possible emotions. They will be considered as conditions that make it difficult to appropriately deal with the relevant stimuli of driving and that favour distraction.

1.3 The significance of distractions

Distractions, regardless of their type, frequently happen while driving. Along this report, we will refer to several studies that show the significance of driving distractions, using different methods (surveys, direct observation, simulations, etc.).

A partial though useful way to understand this significance is through statistics, which show the weight of the different types of infractions as a concurring factor[1] in accidents. The following table shows a breakdown of drivers involved in accidents with victims, both on roads and in urban areas, between 1998, and 2006 in Spain.

1. Factor involved in an accident but conditioned by other risk factors (speeding, consumption of alcohol or drugs, bad weather, state of the road, etc.).

Table 1. Offences of drivers involved in accidents with victims on the road and in urban areas (1998-2006)

Percentages	1998	2000	2002	2004	2006
Distracted or inattentive driving	30,8	29,9	32,4	34,5	34,4
RRelated to speed	21,6	22,9	22,6	22,1	26,0
Not keeping the safety distance	7,3	7,4	6,3	6,6	6,3
No cumplir la señal de Stop	5,9	5,6	5,5	5,5	5,6
GTurning incorrectly	5,2	5,4	5,2	4,9	4,4
Partially invading the opposite direction lane	5,0	4,5	4,3	4,0	4,3
Not observing the right-of-way sign	4,3	4,4	4,2	4,3	3,8
Not observing the general priority rule	4,4	4,1	3,9	3,9	3,8
AOvertaking illegally	3,8	3,7	3,7	3,4	3,1
Not observing the traffic lights	5,1	5,3	4,9	4,4	2,6
Not observing the pedestrian crossing	1,8	1,8	1,9	2,1	1,8
EIntegrating carelessly into circulation	1,2	1,2	1,3	1,3	1,1
Rest of offences	3,7	3,7	3,7	3,2	2,8
Total	100	100	100	100	100

Source: DGT, Statistic Accident Yearbook

As we can see, distractions appear throughout the period of time, as the main concurrent factor in road accidents, even ahead of infractions related to excessive or inappropriate speed. Behind these factors there are other relevant aspects such as not keeping the safety distance, not observing the Stop sign or turning incorrectly.

Beyond the significance of distraction as a concurrent factor in many accidents, we should also highlight that, according to the table, there has been an upward trend in time. If in 1998, distractions represented 30.8% of the infractions committed in the accidents recorded; in 2006 the rate had already reached 34.4%. This means that more than one third of the accidents were related to distractions.

We should however not forget that the above table underestimates the real incidence of distractions on the accident rate, for two reasons: first, because distraction is a factor which is difficult to record in traffic reports; and second, because distractions are frequently related to minor accidents that are not officially recorded.

1.4 Classification of distractions

The classification of distractions considers cognitive, sensory and motor aspects affected by them [7]. According to this criterion, distractions can be visual, auditory, biomechanical or physical and cognitive:

- Visual distraction happens when the driver looses the sight of the road on which he is travelling while engaging in a secondary activity, even if only for a few seconds. A large part of the secondary activities that are usually carried out while driving imply visual distraction.

- Auditory distraction happens when the driver focuses his attention on sounds or voices more than on the traffic situation. The most frequent causes of this kind of distraction are conversations with other passengers, listening to the radio or talking on the mobile telephone.

- Biomechanical or physical distraction refers to letting one or both hands go off the steering wheel or the gear lever in order to manipulate any other object not related to the driving task. Lighting a cigarette, making a telephone call, having a soft drink or reprogramming the navigation device are examples of these activities.

- Cognitive distraction can happen in case of thoughts or other activities that can make the driver become absorbed in such a way that it interferes in his driving task. For example a discussion trying to convince a passenger in the car, having a conversation on the telephone or thinking about the things to be done along the day may cognitively distract the driver.

Many potentially distracting activities or events can include two or more of the mentioned effects. For example, a conversation with the passenger sitting right next to the driver initially means an auditory distraction, but it may produce a visual distraction if the driver turns his head to look at the passenger during the dialogue. If it is a complex conversation it may additionally become a cognitive distraction. The habit of some drivers of gesticulating with the hands while talking, may add a biomechanical distraction effect.

1.5 Classification of distracters

If the distraction is turning the attention of a driver away from the driving task to other things, we could say that the latter are the distracters. We already mentioned in the previous section, that these may be events, activities, objects or people and we have shown a few examples happening both inside and outside the vehicle.

We have used different criteria to classify distracting activities. One of them is the location of the distracting element [8]. According to this criterion, distracters are classified as:

· Internal distracters: When the distracting element is inside the car.

· External distracters: When the distracting element is outside the car.

Examples of internal distracters would be a conversation with a passenger or the call for attention by an animal or a child travelling in the same car.

External distracters are elements outside the vehicle which are not related to the driving task and that may shift the driver's attention. An example would be a vehicle that has had an accident in a ditch.

Other researchers classify distracting activities in two groups depending on whether they are related to the use of a technological device or not [7].

Distracting activities that do not imply the use of technological devices have been carried out since the beginning of the car era. Talking to or looking after other passengers, smoking, drinking or eating while driving are behaviours carried out very frequently by many drivers and that might shift their attention away from the main task, which is driving the vehicle.

The technological advances of recent decades have contributed to increase the amount of parallel activities carried out while driving that may interfere with the driving task as such [7, 9, 10], such as setting the air conditioning system, using the radio and the CD-player, or using the mobile telephone with or without a hands-free set [5, 7, 11]. These and other devices have progressively been included in the vehicles with the general aim of serving as an aid for the driver, but at the same time, they may have a distracting effect.

1.6 Main consequences of distraction

Driver distractions may have different consequences. The most common and dangerous are related to the control of the vehicle itself. The most relevant are listed below, including examples of activities that may cause them [7]:

· Difficulty to control the side position. Trying to reach the sunglasses while driving might lead to a deviation from the circulation lane.

· Poor control of the driving speed. Manipulating the navigation device may make it difficult to adapt the speed.

· Reduction of the safety distance. Using the mobile telephone while driving is connected with a shorter safety distance to the preceding vehicle.

· Reduction of the safety practices. Drinking implies the risk of driving with only one hand during a few moments.

· Increase of the cognitive load. Talking to the passenger next to you increases the perceived mental effort which is needed to drive.

· Increase of the reaction time. The brake reaction time significantly increases while manipulating the audio system.

The effects of distraction on the reaction time have been analysed with simulation studies. It has been observed, that when the driver is carrying out a distracting activity, the brake reaction time increases, i.e. the time needed by a driver to perceive a dangerous situation and to start the braking manoeuvre. This increase is, however, not the same for all activities [11,13]. Table 2 shows the increase of the brake reaction time according to the type of distraction.

Table 2. Increase of the brake reaction time according to the type of distraction and braking distance in every case depending on the driving speed

Distracting activity	Increase
Listening to radio music	4.1%
Talking to passengers	15.6%
Talking on the handheld mobile telephone	18.4%
Talking on the hands-free mobile telephone	18.6%
Choosing a CD track (already inside the car audio system)	29.4%

Source: ISVAS, and Consiglio,W., Driscoll, P., Witte, M. and Berg,W.P. (2003). Effect of cellular telephone conversations and other potential interference on reaction time in a braking response. Accident Analysis and Prevention, 35, 495-500.

As we can see in the table, the brake reaction time increases along with the degree of complexity of the distraction. Available evidence shows as well, that the brake reaction time increases in general with the age of the drivers [14]. Moreover, we have been able to see that, in the case of mobile telephone conversations, the increase of the brake reaction time is even bigger when it is a complex conversation.

In any case, we should highlight that the increase of the brake reaction time has been calculated on the supposition that there is no visual distraction. If there is a visual distraction, i.e. if the driver is forced to look away from the road, the reaction time will increase even more during the distraction time. We will take this issue up again later.

1.7 The danger of distractions

1.7.1 DETERMINING FACTORS

In practice, the danger of distractions depends on three factors: the complexity of the distracting task, its duration and its frequency. These three factors have each a different influence on every type of distraction and their combination eventually determines its effective danger.

Complexity

Complexity means the intensiveness of the shift of attention caused by the distracting activity, be it visual, auditory, biomechanical or cognitive. Table 3 [3] shows some of these secondary activities according to their level of complexity: low, medium and high. For example, adjusting the radio may imply looking away from the road for a short period of time and simply manipulating the radio, but in order to dial a telephone number, you must shift the attention away from the road for a longer period of time, and it usually implies a more complex or longer manipulation of the device [5].

Table 3. Examples of secondary activities according to their complexity level

Low
- Talking to the passenger in the adjacent seat.
- Adjusting the air conditioning device.
- Turning on the radio.

Moderate
- Talking/listening to the handheld mobile phone.
- Inserting or retrieving a CD or cassette.
- Looking at external objects.

High
- Locating, reaching, answering or dialling a number in the mobile telephone.
- Operating a PDA or reprogramming the navigation device.
- Looking after animals or children in the back seat of the car.

Source: Own preparation based on (3) and (5)

A study carried out by the NHTSA [3] with North American drivers, filming and directly observing vehicles in natural traffic situations, found out that engaging in a complex activity increases the risk of having a crash or near-crash by three, whilst engaging in a moderate complex task increases the risk by two times. The complex activity that increases the accident risk most is reaching for a moving object in the car, followed by reading, applying makeup or dialling a mobile telephone. Although looking at external objects which are not related to traffic is considered a moderate complexity activity, engaging in it increases the accident risk by three times. The results of other studies do also confirm the influence of external distracters on the road accident rate.

Duration

The duration of the distraction is a further variable to consider when assessing its danger. In general terms, the duration may vary significantly according to the type of distraction: talking to passengers, listening to the radio or the audio system, talking on the mobile telephone, eating and drinking are some of the simultaneous- to-driving activities that use to have a larger duration [11, 12]. Some of them can last during the whole trip (e.g. many drivers use to have the audio system always on) or a large part of it (such as a conversation with other passengers).

The duration of certain distractions has been calculated in a more detailed way [11]. This is shown in the table below.

Table 4. Time engaged in carrying out certain secondary tasks

Distraction task	Duration of the task
Dialling a mobile telephone	13 seconds
Answering an incoming call	8 seconds
Average duration of a conversation	1.5 minutes
Lighting a cigarette	4 seconds
Adjusting the radio or CD-player	5-6 seconds
Frequency of radio manipulation	8 times/hour of driving

Source: Stutts, J.C., Feaganes, J., Rodgman, E., Hamlett, C., Meadows, T., Reinfurt, D., Gish, K., Mercadante, M. and Staplin, L. (2003). Distractions in everyday driving.Washington: AAA Foundation for Traffic Safety

The duration of these distractions is lower than those mentioned above. However, their impact can be very significant, since they are usually visual distractions that consequently imply looking away from the road.

Frequency

The frequency with which drivers engage in distracting activities is a further element to be considered when assessing the danger of distractions. It varies a lot according to the type of distraction. In a study carried out, filming drivers during a three-hour route, it was observed, that almost all of them manipulated controls inside the vehicle (air conditioning, windows, etc.) and tried to reach for something either stretching out their hand and/or leaning while they were driving. Nine out of ten manipulated the audio equipment and 85% were distracted by some element outside the vehicle. Talking to a passenger and eating or drinking were carried out by more than seven out of ten drivers. Other behaviours carried out by a large part of the drivers were eating or drinking, grooming (brushing hair, putting on makeup, etc.), reading or writing or talking on the mobile telephone.

From a more general point of view, available evidence [7, 8] shows that the most frequent distractions are related to the use of technological devices.

Table 5. Most frequent distractions affecting the driving task

Adjusting radio controls[1]
Talking to a passenger[1]
Dialling a mobile telephone[1]
Talking on the mobile telephone[2]
Searching and answering the mobile telephone when it rings[2]
Reading a document or map while driving[2]
Picking up objects from the floor or between seats
Reaching for the car tray
Looking after children
Entering destination information into the navigation system

1. Kristie Young, Michael Regan and Mike Hammer, Driver distraction: a review of the literature, Monash University, 2003. 2. La distracción en la conducción, Fundación RACC, 2006

Obviously, these classifications vary as cars are fitted with new technological elements.

As regards the most frequent distractions carried out by external factors or elements, available evidence shows that they can be very varied. The following table shows the ten most relevant distractions admitted by Spanish drivers in a recent survey.

Table 6. Most frequent distractions caused by external elements

Pedestrians who are going to cross the street
Looking for a car park
Bike riders riding to close
Road works
Other vehicles getting to close
Presence of traffic police
Accident sites
A sign/hoarding
Emergency vehicles arriving
Confusing or badly located sign-posting

Source: La distracción en la conducción, RACC 2006

This classification may vary according to the countries. In Australia, for example, drivers asked about the accident risk implied in engaging in certain distracting activities highlighted: taking notes (62%), reading maps/newspapers (59%), talking on the mobile telephone (40%), looking at attractive pedestrians (17%), drinking (17%), watching advertising (15%), eating (15%), operating CD-player (13%) and talking with the hands-free device (9%) (16).

1.7.2 TYPOLOGY

The danger of distractions is positively correlated with its complexity, duration and frequency. Although it is not possible to establish a danger ranking of distractions, we can deduce from what has been said so far, that complex distractions are, in general terms, very dangerous, regardless of their duration and frequency. The table below shows a list of the most relevant distractions with a high complexity degree. As we can see, all of them are visual distractions.

Table 7. Distracting activities with high complexity, and variable duration and frequency

Activities	Complexity	Duration	Frequency
Trying to find something reaching out the hand and/or leaning	High	Low/Moderate	High
Locating, searching or answering the mobile telephone	High	Low/Moderate	Moderate
Dialling a telephone number	High	Low	Moderate
Reading a PDA or an SMS	High	Moderate	Moderate
Programming the navigation device	High	Moderate	Moderate/Low
Looking after animals or children in the back seat	High	Moderate	High if travelling with children or animals
Putting on makeup	High	Moderate	Moderate

Source: Own preparation

We have to highlight, however, that there are several distractions that are not as complex but very dangerous as well, since they have a long duration or are carried out with more frequency.

The table below shows a list of this type of distractions.

Table 8. Distracting activities with long duration and high frequency and variable complexity

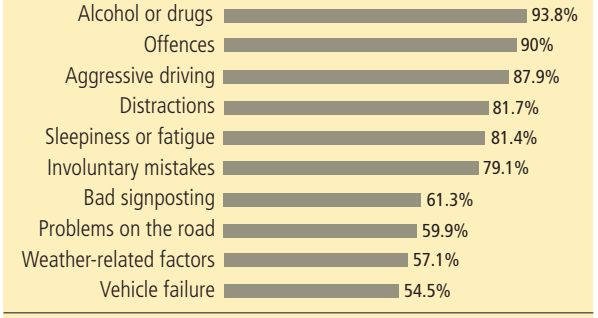
Activities	Complexity	Duration	Frequency
Looking at external objects	Moderate	Low/Moderate	High
Inserting or retrieving a CD or cassette	Moderate	Low	High
Talking on the mobile telephone	Moderate	High	Moderate
Eating or drinking	Moderate	High	Moderate/High
Smoking	Low	High	High among smokers
Talking to passengers	Low	High	High
Manipulating controls inside the vehicle (air conditioning, windows, etc.)	Low	Low	High
Turning on the radio	Low	Low	High

Source: Own preparation

1.8 The opinion of drivers on distractions

In general terms, available evidence shows that drivers tend to underestimate the significance of distractions. In a survey carried out in Spain, for instance, drivers defined distractions as the fourth concurrent factor in accidents, behind driving under the influence of alcohol or drugs, offences and aggressive driving.

Chart 2. The opinion of drivers about which are the main causes of road accidents



Source: RACC 2006

This fourth position is in contrast to the previously mentioned fact that distractions appear clearly as the main cause of road accidents in Spain. Moreover, as has already been said as well, the weight of distractions as the cause of road accidents has shown an increasing trend in Spain in recent years. In any case, what should be highlighted is that distractions are a significant, unperceived risk factor.

It is important to mention, however, that the significance attached by drivers to distractions as an accident risk factor, varies depending on whether they are talking about serious or minor accidents. In a study carried out in Australia, for instance, distraction was on fourth place as a factor causing serious accidents, while it was clearly considered the number one cause of minor accidents. This suggests that there is also an underestimation among drivers about the seriousness of the consequences of driving distractions.

1.9 Factors favouring distraction

Altered physical and emotional states have a great influence on driver distractions, since they can favour them. Although in some studies there is a certain terminological confusion, these states cannot be considered distractions by themselves, but rather states of the person that favour distraction. We will take a closer look at the most important below.

Drinking alcohol and taking other similar drugs reduce the attention ability and alters the perceptions of drivers, and at the same time harms the motor functions and increases the reaction time against unforeseen situations. It is usually also accompanied by states of euphoria that make people overvalue their physical and intellectual abilities [17, 18, 19]. Likewise, there are some medicines (antihistamines, tranquillizers, etc.) with effects on the central nerve system that imply major risks and can even strengthen the effects of alcohol due to the cross-tolerance between both substances [19].

Furthermore, driving while being tired and sleepy involves a very high risk, not only because you may eventually fall asleep, but also because during that previous phase you do not perceive all elements required for safe driving clearly enough, nor are you in appropriate psychophysical conditions to give quick responses if they are needed [6, 20].

Boredom due to the lack of environmental stimuli (long straights without traffic and surrounded by monotonous landscapes) combined with fatigue usually favours falling asleep. The same happens with alcohol consumption [19], after a heavy meal, rich in carbohydrates or with high temperature in the car [17], as well as at certain times of the day, when the state of alert regulated by circadian rhythms fades.

But an excess of brain activity or intense emotions are not good for safe driving either. For example, a stressed, nervous or angry driver can get distracted much easier, either because his/her thoughts are with the issue that is worrying him/her or because he/she is hyper reactive against stimuli that are not really relevant. It has been proven, for instance that aggressive drivers, talking on the phone, drive faster and brake later than non-aggressive drivers [21]. Some stimulating substances, such as caffeine and nicotine can cause psychomotor excitement and mental confusion if taken in high doses [19].

Last but not least, if the driver feels ill (with fever, body pain, sickness, etc.) his/her driving abilities may be negatively affected and moreover his/her attention will be repeatedly focussed on the felt symptoms instead of concentrating on the driving task.

Drivers usually say that they are aware of the influence of their physical and emotional state on their ability to concentrate. The danger and risk of having an accident involved in driving under the influence of alcohol are recognised by most of the drivers. Likewise, when they are asked about the situations that usually lead to inattention in the driving task, those surveyed mention as the most frequent factors: hurry, worries, euphoria, nervousness and tiredness; and as factors with the biggest ability to create distraction: alcohol consumption, sleepiness, allergies and other illnesses, and worries [22]. It is also worth mentioning that when the causes for the lack of attention while driving are examined, the most frequent answer is that they were concentrated on their thoughts.

But recognising the significance of these situations with regard to the concentration ability while driving does not necessarily mean that in practice, drivers will take the appropriate preventive measures to try to avoid them.

1.10 Distraction and speed

The risk involved in distractions is directly related to the speed of the vehicle: higher speed, higher risk. This explains, at least partly, the effect of the speed reduction observed in many drivers when they are talking on the handheld mobile telephone. As already mentioned, it is an instinctive precaution, trying to minimise the risk.

A way to gauge the risk derived from the distraction-speed pairing is the time needed to avoid a collision. This time depends, in practice, on three factors[2]:

1. Distraction time: is the time during which the driver looks away from the road because of the distraction.

2. Reaction time: is the time it takes the driver to react (applying the brake, for example), once he/she has perceived the risk.

3. Braking time: is the time needed for the car to stop completely after applying the brake.

These three times correspond to a travelled distance which in turn depends on the speed of the vehicle. The total distance is equal to the safety distance needed to avoid any collision.

Table 9. Speed and distraction

Distraction	Duration of the distraction (s)[1]	Speed (m/s)	Distance covered during distraction (m)	Distance covered during reaction (m)	Distance covered during braking (m)[2]	Total distance covered (m)
Manipulating CD/radio	3 s	50 km/h	41.7	5.6	12.3	59.5
		100 km/h	83.3	11.1	49.2	143.7
		120 km/h	100.0	13.3	70.9	184.2
Dialling a mobile telephone number	6 s	50 km/h	83.3	5.6	12.3	101.2
		100 km/h	166.7	11.1	49.2	227.0
		120 km/h	200.0	13.3	70.9	284.2
Lighting a cigarette	2 s	50 km/h	27.8	5.6	12.3	45.6
		100 km/h	55.6	11.1	49.2	115.9
		120 km/h	66.7	13.3	70.9	150.9
No distraction	0 s	50 km/h	0.0	5.6	12.3	17.9
		100 km/h	0.0	11.1	49.2	60.3
		120 km/h	0.0	13.3	70.9	84.2

1. The duration of the distraction stems from table 4.
2. The reaction time is considered to be 0.4 seconds in all cases. The actual reaction time changes according to the distraction (table 2).
Source: Own preparation

As can be seen in the table, the total covered distance is significantly different according to the speed. In the three cases considered, the safety distance needed to avoid any collision is almost three times higher when the speed increases from 50 to 120 km/h. Distraction and speed become thus a pairing that significantly increases the risk level while driving.

2. There is an additional time, which is between applying the brake and the effective braking start of the vehicle. This time has been omitted for complicity reasons.

1.11 Analysing distractions

There are different ways to assess driving distractions. The most frequent are: asking drivers, checking data records, observing drivers while driving or analysing studies made with driving simulators. All of them have advantages and disadvantages and the degree of reliability and validity of the information obtained is also variable.

The easiest way to assess distractions is asking drivers directly what they were doing when they got distracted, in which context it happened and which were the consequences. This self-reports can be given verbally during an interview or in written by means of a questionnaire, and they are usually instruments easy to explain and to apply. However, some drivers have difficulties to remember past events exactly, without forgetting the cuts that can be made due to social desirability (any person involuntarily tends to leave out information that would make him/her look bad in front of the assessor and to give the favourable information). It can obviously also be intended fake, especially in those cases in which the distraction is legally penalised or can be used by insurance companies to the detriment of the distracted customer. In general terms, the self-reports offering the highest confidence and credibility are those given anonymously during or immediately after driving [23].

Even though, we have to consider that drivers are often not aware of the distraction degree. As a consequence, surveys, insofar as they are getting a subjective perception, may incur in an undervaluation of the problem. We will refer to them later.

1.11.1 RECORDS

Distractions occurred while driving can also be assessed by means of checking accident records [24]. In some countries, the information about the factor or factors causing the accident is recorded systematically. The disadvantage of these records is that they are not always based on the information given by the people who were on site when the accident happened. Moreover, the information gathered in this way is usually not very detailed, and therefore there is a large margin for improvement in order to get to know more details about the significance of distractions in accidents that really do happen.

1.11.2 DIRECT OBSERVATION

An assessment method that offers a high reliability and validity degree is observation by means of devices installed for several days in private cars [1, 7]. Although the person involved usually changes his/her usual habits at first, because he/she knows that his/her behaviour is being recorded, they relax after some time and go back to a more natural and spontaneous behaviour. It is worth mentioning, that even knowing that they are being watched, drivers frequently engage in distracting activities while driving.

1.11.3 SIMULATORS

The assessment by means of driving simulators is one of the most widely used assessment strategies in recent years [23]. The simulator may have different similarity levels with natural situations. There are high and low fidelity simulators [7]. As regards high fidelity simulators, the environment in which the vehicle is supposed to be driving is realistic and includes the usual elements of a road or street: trees, buildings, signposts, etc. The cockpit in which the controls to simulate the driving task are located is also similar to that of a real vehicle. Whereas in low fidelity simulators, everything is more simple, both the environment (usually black and white, only indicating the lines to follow on the road) and the cockpit. By using simulators we can get more complete and exact data about the different behaviours we are interested in, avoiding the risk inherent to a real traffic situation. In addition to the high cost, the main disadvantage of these assessments is that since it is a simulated situation, the performance of the driver may not be representative for his/her usual behaviour in a real traffic situation, as the consequences of his/her behaviour will in no case be dramatic [7].

Simulators have been widely used to assess the interference degree in driving of several technological devices, analysing dual tasks. These analyses start from the idea that carrying out two simultaneous tasks that involve the same senses will create interferences that will end up significantly harming one of them [23].

1.11.4 OTHERS

Other assessment strategies offering scientific guarantees to obtain data about driving distractions are eye glance monitoring, the visual occlusion method and the 15 Second Rule [7]. There is a large amount of literature explaining these strategies (Revisión del estudio del arte sobre la distracción de los conductores. Mineo. ISVA, Madrid 2006).

As the reader might have noticed already, with most of the methods we have reviewed, we can only assess distraction with a visible origin, be it inside or outside the vehicle. Only self-reports can provide information about the thoughts or the physical feelings that may also distract drivers.

In short, the main objectives of distraction assessment is knowing the frequency with which drivers engage in secondary activities that may distract them, how this activities affect the driving task and which is their connection with the road accident rate. This information can be of major interest to authorise or prohibit the use of certain electronic devices while driving, to plan preventive interventions focussed on more dangerous distractions and to help the driver manage them in a more appropriate way once they happen.

Box 1.1. What does the legislation currently in force say about distractions?

The Spanish Road Safety Law and the General Driver Regulations do not include distractions as a figure with special treatment. In fact, the term distraction does not appear as such in the wording of the said rules. In its current wording, the law does only mention specifically some distracting activities.

In overall terms, the rule establishes that drivers must drive with diligence and precaution to avoid any damage to themselves or other people. Likewise, they state that drivers must be at all times in condition to control their vehicles or animals. In this sense it is specified that the driver of a vehicle must keep his/her freedom of movement, the needed visual field and permanent attention to the driving task, so as to guarantee his/her own safety, the safety of the vehicle occupants and the safety of other road users.

It is also stated that the driver must have especial care to keep the correct position as well as the passengers, and look after the appropriate positioning of objects or animals that are being transported in order to avoid any interference.

To be precise, using the mobile telephone manually, headphones or any other device which is incompatible with the compulsory permanent attention to the driving task is considered as a serious offence. This offence may imply the loss of 3 points of the driving licence and a fine of 91 to 300 euros.

Likewise, according to the regulations, all devices with images that may distract the driver, such as screens with Internet access, TV screens and video or DVD-players are strictly forbidden. The only exception are those devices which, despite being visible to the driver, serve as driving aids, such as the GPS.

The Law does not mention other distracting activities in which technological devices are not used, such as smoking or eating while driving.

Box 1.2. Most frequent features of accidents due to distractions

Type of accidents: Leaving the road, rear-end crash or run-over accidents
Time period: With enough light
Road layout: Usually straight
Weather conditions: Most of them normal (not adverse)
Traffic density: Usually low

A large part of driving distractions happen during favourable trips and traffic conditions, since the driver perceives less danger and tends to relax his/her attention.

DGT, (1999); Spanish Ministry of the Interior, (2007a); RACC (2006)

Box 1.3. Do all drivers get equally distracted?

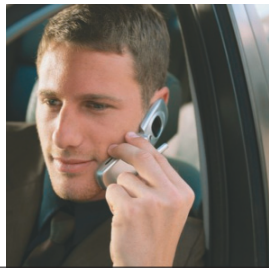
Characteristics of drivers more frequently involved in dangerous traffic situations due to distractions:

- **20 years or younger**
- **Little driving experience**
- **Men and women**
- **Previously sanctioned due to traffic offences**

The main cause of distraction among young drivers is related to engaging in a second activity (using the mobile telephone, manipulating the audio system, etc.).

Drivers who are 65 years or older carry out these activities with less frequency but have more difficulties to perceive potentially dangerous traffic situations. These limitations are usually compensated with slower driving.

Horberry et al. (2006); Klauer et al. (2006); Lam (2002); Stutts et al. (2001)



Chapter 2

Technological distracters

"There are several factors that can make your driving performance less effective than it should be. You can get distracted using your GPS, radio, mobile phone or talking with the hands-free set because you are not focussed on the road. All technology devices have to be activated before starting off."

Marc Gené, Formula 1 driver

2.1 Introduction

As expected, with the passing of time, cars have been including new devices with an increasing technological sophistication. These instruments are used for several different purposes, such as increasing safety, improving comfort or making orientation and arriving to destinations easier for drivers, among others. In general, these instruments substantially improve the features of cars.

However, the bad use or wrong design of these devices may significantly increase the activities favouring distraction inside the vehicle and in the last analysis, the risk of having an accident. Therefore it is only right to talk about technological distracters, i.e. technological devices that if used inappropriately may shift the drivers' attention. Due to their significance, we are going to refer to three of them in the sections below: mobile telephones, navigation devices and audio systems.

2.2 The use of mobile telephones while driving

2.2.1 INTRODUCTION

Using a mobile telephone while driving is a distracting activity that has been the topic of a large number of studies in recent years, in parallel with the increasing popularity of these devices. Some of these studies assess the frequency of use of mobile telephones among drivers [1, 2], others focus on determining its impact as distracting activities [3, 4, 5] or in a more direct way, relate its use to road accident rates [6, 7]. Research works comparing the effect of a conventional mobile telephone with a hands-free set are also frequent [8, 9].

The reason why so much attention has been paid to this device is no fluke. It is with no doubt one of the distracting activities that has increased most among drivers in the last decade [6, 10, 11], as quickly as the use of mobile telephones became popular.

2.2.2 THE USE OF MOBILE TELEPHONES AND DISTRACTION

Using a mobile telephone needs a series of actions, some of which are extremely complex, whilst others may need a long time to carry them out. For instance, let's think about a driver travelling in his vehicle, when suddenly, his mobile telephone rings and he does not have a hands-free set. If he decides to answer, he will first have to look for the telephone. It will not always be at his reach. It is often in a bag or in a jacket, for example. This action alone can be dangerous since the driver has to look away from the road, take one hand off the steering wheel and sometimes lean over to be able to reach the phone. The next action would probably be to look at the display to see who is calling and decide whether to answer the call or not. If he decides to answer, one of his hands will be busy during the whole conversation time.

To all these distracting effects we have to add the possible cognitive effect the conversation with the person calling can have on the driver. This effect is more difficult to measure, but not less important. Thus it has been estimated that talking on the mobile telephone has an effect that can be compared to talking to a passenger sitting next to you and its distracting ability would be directly related to the complexity and the content of the conversation. Moreover, it has been confirmed that while talking on the mobile phone, drivers take less time to carry out activities related to the driving task, such as checking the speedometer or looking in the rear-view mirror.

From all of the above we can gather that when we use the mobile telephone without a hands-free set while driving, there is visual, auditory, biomechanical and cognitive distraction. When using the hands-free set the visual and biomechanical distraction is less, but it still causes auditory and cognitive distraction [12]. We will insist on it later.

2.2.3 THE USE OF MOBILE TELEPHONES AND THE RISK OF HAVING AN ACCIDENT

The results of research works carried out on the use of the mobile telephone while driving agree insofar as they establish a relevant distracting effect caused by this activity. However, it is difficult to determine its direct connection with the road accident rate. Thus, some studies that relate the frequency of using the mobile telephone with the road accident rate do not state whether the device was being used at the moment of the accident; they just analyse the connection between the frequency of use and the frequency of accidents. The connection found may have an alternative explanation: the most imprudent drivers usually use the mobile telephone with a higher frequency while they are driving [16] and this will probably not be their only risk behaviour, so that the accident rate of this group will probably be higher.

And yet the available evidence shows that the use of the conventional mobile telephone while driving significantly increases the collision risk. According to a study carried out in North America [7], this risk could be four to six times higher than the risk in normal driving conditions. In line with what has been said in previous sections, this would place the conventional mobile telephone among the distracting activities with a higher accident risk.

Evidence gathered from the information provided by the traffic police and the drivers themselves also point in the same direction. Thus, 2% of the 1,367 drivers who had suffered an accident and were interviewed in a recent study [19], informed that they were using the mobile telephone when the accident happened. Only four years before, 0.6% of the accidents had the use of the mobile telephone as a direct cause. This difference leads us to think that the accident rate connected to the use of this device is tending to increase, which sounds only logical considering the generalisation of the use of mobile telephones in recent years.

Last but not least we have to mention that the use of mobile telephones by pedestrians when crossing the street can also increase the accident rate. Due to the cognitive distraction caused by the conversation, pedestrians cross the street slower and it is more likely that they will do it without making sure that there are no vehicles coming, thus increasing the risk of run-over accidents [21].

2.2.4 THE FREQUENCY OF USE OF MOBILE TELEPHONES WHILE DRIVING

According to data of the Spanish Traffic Authorities (DGT), nine out of ten Spanish drivers have a mobile telephone with them while driving and eight out of ten have it switched on. 33% admit that they have used it during their last trip [14]. Likewise, in a study carried out with a sample of 371 Spanish drivers aged between 22 and 75 years, 58% of those surveyed admitted that they talk on the mobile telephone with more or less frequency while driving, and 27% use the device to read or send text messages as well [2]. Given the still poor implementation of hands-free devices in our country, the above data refer essentially to the use of the conventional mobile telephone while driving and in this sense, point to a generalisation of offending activities.

We have to mention, however, that the implementation of the points-based driving license seems to have had a major effect on the use of mobile telephones while driving. According to a recent study [15], 9% of the drivers declare not to use the mobile telephone while driving anymore since the law came into force. It is possible that this trend will get strengthened with time, especially if combined with information and control campaigns[3].

It is interesting to highlight in this sense, that there is evidence suggesting that not using the mobile telephone while driving is stronger connected with driver education than to the existence of a prohibition. In New Zealand, for instance, where the use of mobile telephones while driving is not prohibited, only 3.9% of the observed drivers actually used the device while they were driving [13].

2.2.5 DRIVER TYPOLOGY

As expected, the frequency of the use of mobile telephones seems to be inversely related to the danger perception of the driver: those drivers perceiving the attitude as less dangerous are those who use it with a higher frequency [17]. Younger drivers do also use the mobile telephone more often.

On the other hand, it is interesting to see that the distracting effect of the use of mobile telephones is not identical for all drivers. It seems that it depends on the age and the gender. For example, some studies have shown that the brake reaction time while talking on the phone is longer among women aged 55 to 65 years compared to men of the same age group or to younger men and women (25-36 years) [4].

2.2.6 THE HANDS-FREE MOBILE TELEPHONE

The hands-free mobile telephone shows, in principle, clear advantages in terms of a less distracting capacity compared to the conventional mobile telephone. It has essentially two big advantages:

- On the one hand, since the controls are built in the dashboard of the car, it is much easier to use, significantly reducing the possibility that the driver gets visually distracted while manipulating the telephone.

- On the other hand, it also avoids mechanical distraction, since it allows the driver to drive with both hands on the steering wheel all the time.

3. In this sense, it is interesting to consider, that a large part of the points that are being removed are due to the undue use of the mobile telephone. To be precise, on 23 June 2008, 12% of the reports involving the loss of points were due to this reason.

In terms of cognitive distraction, the hands-free mobile telephone has obviously the same risks as conventional mobile telephones. These risks have been explained in previous sections.

There is evidence, however, that somehow smoothes down the benefits derived from the use of hands-free mobile telephones. In particular it refers to three aspects:

- First, it has been observed that when drivers need to use their hands for the telephone, they tend to compensate the distracting effect slowing down the car, while if they are using the hands-free set they do not [11, 18]. The perception of danger in both behaviours might be different: drivers might perceive that talking on the phone is more dangerous when they have to use at least one of their hands to do so, while if they use the hands-free set they consider that a compensating attitude is not necessary. Another possible interpretation of these results is that the presence of the telephone in their hands serves as a reminder for the drivers to increase prudence, since they perceive that their abilities are decreased due to the distracting effect of this device.

- Second, results of different studies confirm that drivers with a hands-free set tend to talk more frequently on the phone while driving, than those who use a conventional mobile telephone [2, 17]. As in the previous case, this is likely to be related to a lower risk perception by the driver while using the hands-free set.

- Last but not least, and although there is no scientific evidence in this sense yet, what we have just reasoned indicates that the lack of perception of the risk associated to the use of hands-free mobile telephones might end-up with drivers having longer conversations, thus increasing their cognitive distraction.

All of this suggests that despite the obvious advantages of hands-free mobile telephones compared to conventional telephones, it is not risk free. And, in this sense, it shows the need to educate drivers in order to make them avoid or minimise these risks.

2.3 The use of navigation devices

2.3.1 INTRODUCTION

The main task of navigation devices is to serve as a guide for drivers, and to show them the route to follow. Their use has become more and more popular in recent years given the great help they provide to drivers when they have to make large, unknown trips or find a specific address inside or outside city centres. Navigation devices can also provide additional information, such as for example the state of traffic or services available to the driver along the route. Therefore they are a help to improve road safety or to increase comfort during the trip.

Although this device was originally conceived to help drivers, their increased use has also increased worries about their possible distracting effect [22, 23]. Like in the case of the mobile telephone, the distracting effect is linked to the inappropriate use of navigation devices by drivers.

2.3.2 THE USE OF NAVIGATION DEVICES AND DISTRACTION

The use of navigation devices provides a great service to drivers, and their potential distracting effect is compensated by the advantages, as long as the driver programmes his/her device while the car is stopped and only follows the indications while driving. But what happens if a driver programmes the navigation device after having started the trip?

This situation is rather frequent and it usually happens when drivers forgot or did not have time to programme the device before starting off, or when they try to correct a route that was programmed wrongly or when they decide to change the destination or keep it, but using a different itinerary [22].

Entering the route into the navigation device step by step and by hand needs much more time that dialling a telephone number. The minimum time needed to choose an interesting route is more than one minute; that is three times longer than the time needed to establish a telephone call [26]. The results of a more recent simulation study have found even quicker programming times of between 27 and 49 seconds [27]. But it is still a very considerable duration that may involve significant risks while driving.

Due to the long time needed to introduce the destination, either per voice or manually, some navigation device manufacturers have limited the use of certain features of the system while the vehicle is in movement.

In any case, we can conclude that in general terms, the use of a navigation device while driving is a visual, biomechanical and partly auditory distraction.

2.3.3 THE USE OF NAVIGATION DEVICES AND THE RISK OF HAVING AN ACCIDENT

Although there are several studies focussed on the use of mobile telephones as a factor involved in road accident rates, not many of them take the use of navigation devices into account. One of them analysed the distractions associated to 5,740 fatal accidents and there was no case indicating that the driver was manipulating a navigation device at the moment of the accident [28]. No evidence in this sense was found in a more recent study either [19]. But even tough, it seems unquestionable that the wrong use of navigation devices can have a major distracting effect and thus increase the risk of having an accident.

2.3.4 DRIVER TYPOLOGY

The distracting effect of navigation devices is not the same for all drivers. The age and the previous experience in using these devices are connected with this effect. A study carried out among North American drivers found out that drivers aged 65 years or older, compared to younger drivers, have more trouble manipulating the navigation device while driving and try to make up for it driving slower and extra careful. Moreover as the experience in the use of these devices increases, drivers learn new strategies to use them in a more efficient and safe way [25].

2.3.5 NAVIGATION DEVICE VS. ROAD MAPS AND STREET PLANS

The alternative to navigation devices if you do not know the route to follow or how to get to a certain destination is looking at road maps or street plans. An experimental study on the distracting effect of navigation devices on the driving task compared to the use of traditional maps and plans concludes that their distracting effect is lower than that of the latter [24]. Moreover, when the navigation device provides the information verbally, the distracting effect is much lower than when the route to follow is only indicated on a screen, since the visual attention demand is higher [24].

2.4 The use of car audio devices

2.4.1 INTRODUCTION

The audio system is probably the first potentially distracting technological device included in vehicles. It was originally only a radio, which was then followed by a radio-cassette player, progressively becoming more and more sophisticated audio systems.

2.4.2 THE USE OF A RADIO OR CD-PLAYER AND DISTRACTION

Listening to the radio or a film which is being shown to the passengers in the rear seats of the vehicle does not seem to have a relevant distracting effect on drivers [32]. In a simulation study with Australian drivers, it was found that their ability to drive a vehicle showed almost no change under these auditory stimuli [33]. It seems that the cognitive demand involved in listening to the radio or to a film while driving, can be taken on by most of the drivers, since when the traffic conditions demand a higher attention, they almost automatically give priority to driving to the detriment of listening; whereas while having a conversation on the telephone, the driver might feel under pressure to continue talking, regardless of the traffic situation. Other investigators have also found out, that if you are only listening and you are not forced to talk, the driving task is not affected [8, 33] and the same opinion is shared by drivers [30].

On the contrary, there is a distracting effect when the audio system is manipulated while driving. Manipulating the audio system (especially if the system is not integrated in the steering wheel) may involve looking away from the road for a considerable time (between 3 and 6 seconds) [35] and taking one hand off the steering wheel [31].

An experimental study carried out among young North American drivers observed that when they were manipulating the radio they were more often faster than the legal speed limit and they had more accidents than when they were not engaged in this distracting activity. They also went off the lane more often (crossing the median or leaving the road completely) when they were tuning to a radio station. This mistake was made more often when they were driving in a situation of low traffic density [34].

Some vehicles include CD-players in the boot of the car. These sophisticated devices can play sequentially several discs so that the driver, if he wishes, may enjoy music throughout the trip without having to manipulate the audio system. Previously tuned radio stations and automatic radio tuners, available in several modern audio systems do also minimise the distracting effect that the fact of manipulating can have on the driver.

In any case, we can conclude that manipulating the audio system or CD-player can entail visual or mechanical, and in some cases even auditory distraction.

2.4.3 THE USE OF A RADIO OR CD-PLAYER AND THE RISK OF HAVING AN ACCIDENT

Available evidence, though scarce, shows that manipulating an audio system significantly increases the risk of having an accident. In a study carried out in Great Britain based on police reports about the causes of fatal accidents, the manipulation of audio systems was on top of the list of technological distracters connected with the accident [28].

Although the distracting effect of manipulating an audio system might be smaller than the effect of the use of other technological devices such as the mobile telephone or the navigation device, its role as distracter and concurrent factor in accidents should not be underestimated [23].

2.4.4 THE FREQUENCY OF USE OF A RADIO OR CD-PLAYER WHILE DRIVING

In a survey study carried out with a sample of more than 36,000 Canadian drivers, nine out of ten admitted that they listened to the radio or a disc player while driving and 55% manipulated their audio system during their trip [30]. However, these data might be underestimated since in during an observational study carried out with 70 North American drivers [31], 91% of them manipulated their audio system in some moment during their trip. By ages, the total of under-50-year old drivers, 86% of those aged 50 to 59 years and 71% of those who were 59 years or older engaged in this activity. In average, drivers dedicated 1.4% of the trip to manipulating the device and during 71% of the time observed there was some type of sound (music or conversation) coming from the audio system. The audio system is used more often when driving alone [29].

Chapter 3

Non-technological distracters

"There are some disturbing external agents. I don't like too much advertising on the road. It is confusing and distracting... and that's not good."

Carlos Sainz, rally driver

3.1 Introduction

In this chapter we will talk about those distracters which are not related to the use of technological devices, specifically to the effects of distracters located inside the car, such as smoking, eating or drinking and the effects of external distracters such as traffic signs on public roads.

3.2 Smoking while driving

3.2.1 SMOKING AND DISTRACTION

Smoking is a distracting factor while driving, due to the series of actions with different complexity and temporality needed. For instance, let's imagine a driver travelling in his car, who suddenly feels the wish to have a cigarette. If he decides to satisfy his wish immediately, he will first have to look for the pack of cigarettes. The pack may be at reach but it may also be in the glove compartment, in a bag, a back-pack or in the jacket. The movements needed to get the pack, which may involve looking only inside the vehicle, driving with only one hand and leaning over, are already dangerous while driving.

Then the driver will have to find the cigarette lighter, either the one of the car which is usually included in the central part of most of the vehicles, or the own lighter which can lead to a repetition of the set of behaviours described above. Once the cigarette is lit and while smoking, the driver will need to use the ashtray frequently, taking the hand off the steering wheel and looking away from the road to do so. And there is the risk of ashes or even hot pieces falling on the driver or inside the vehicle including the possibility of burning. He will finally have to put out the cigarette, which means another reduction of the safe driving behaviour.

To all of this, we have to add the effects on the nerve system caused by the progressive concentration of the carbon monoxide in the tobacco smoke which is directly inhaled, in addition to that of the vehicle. The combination of carbon monoxide and haemoglobin in high concentrations can reduce night vision leading to driving mistakes [4].

3.2.2 SMOKING AND THE RISK OF HAVING AN ACCIDENT

The analysis of the connection between smoking while driving and the road accident rate has given contradictory results and there is no doubt that it needs deeper research in the future [5]. For instance, there was no connection found between smoking and road accidents among Canadian drivers [6]. However, among North American drivers, it was found that the risk of having an accident was 1.5 times higher for smokers than for non-smokers and that the trend to smoke while driving even increased the risk. The connection observed between smoking and a higher risk to have a road accident was due to three factors: the distraction due to smoking, different behaviours in general among smokers and non-smokers and the toxicity of carbon monoxide [7].

As regards Spanish drivers, available evidence shows that the road accident risk can be even 50% higher for smokers than for non-smokers [7]. The risk is a little higher for smokers smoking while driving compared to those who do not. Likewise, it is been confirmed, that smoking drivers, compared to non-smokers, have received more fines due to driving offences.

The reasons suggested to explain the higher risk of having an accident among smoking drivers include: more distraction (not being able to use both hands when driving, eye irritation due to the smoke), different behaviour of the drivers in general (bigger trend to take risks), the direct effects of carbon monoxide that reduce the attention capacity and medical problems due to smoking (especially cardiovascular disorders). It has not been possible to determine the individual significance of each of these factors so far.

It is interesting to mention, that the higher the frequency of smoking while driving, the lower the danger perceived, but on the contrary, the higher the frequency of accidents reported. This indicates an extreme case of unperceived risk, in which distraction between perceived and real risk is even bigger than in the case of non-smoking drivers.

3.2.3 THE FREQUENCY OF SMOKING WHILE DRIVING

Recent surveys carried out among the general Spanish population show a prevalence of daily tobacco consumption of 32.8%; to be precise, 37% of men and 28.6% of women smoke [1]. Smoking, given its addictive nature, is usually combined with other daily activities such as driving. The table below shows the frequency of smoking while driving by smoking drivers.

Table 10. Frequency of smoking while driving by smoking drivers

Never	25.7%
Sometimes	40.9%
Often	18.2%
Always	15.2%

Source: Spanish Health and Consumption Ministry (2007). Household survey on alcohol and drugs in Spain 2005-06.

As can be seen, three of every four smokers admit smoking with a higher or lower frequency while driving, which means very high percentage [2].

3.3 Eating or drinking while driving

3.3.1 EATING OR DRINKING AND DISTRACTION

Eating or drinking while driving is a distracting activity which involves a range of actions. For instance, let's think about a driver travelling in his vehicle, when suddenly, out of pleasure or due to the lack of time, he feels the need to eat or drink. First, he will have to find the food or beverage. Depending on whether it is at reach or kept in a bag, he will have to carry out movements to reach for it, look inside the vehicle and take at least one hand off the steering wheel. Then, he will have to prepare the food (i.e. open the bag, take off the wrapping) or the beverage (open the bottle or the can, place the container in a way to avoid spilling). This will also involve the reduction of safe driving behaviour. Likewise, while eating or drinking, he will have to repeat several movements to reach and place back the food or beverage until he has finished.

3.3.2 EATING OR DRINKING AND THE RISK OF HAVING AN ACCIDENT

There is not much information available or studies connecting the fact of eating and drinking with the risk of having an accident. It is known, for example, that the rate of North American drivers involved in road accidents while being distracted due to eating or drinking (1.7%) is higher than the rate of those drivers who got distracted due to the mobile telephone (1.5%) [3], although it is likely that this is connected with the fact that eating or drinking is one of the most frequent activities carried out by North American drivers while driving.

The distracting effect of drinking or eating while driving was analysed in Great Britain simulating a typical urban scenario. At some points of the route, which coincided with the instruction of eating or drinking, an incident was simulated, programming a pedestrian who would walk in front of the vehicle. They observed an increase of the perceived mental load and the risk of accidents on the group of drivers who were eating or drinking, compared to those drivers who were not engaged in these activities [8].

3.4 Road signs and distractions

The driving task is carried out in a complex visual environment which includes signs, electronic boards, advertising and public art facilities, among others. We should ask ourselves what effects this environment may have on the driving ability and the accident rates. Reviewing the studies carried out in North American natural driving atmospheres, we have noted that the more signs and electronic panels, the higher the accident rate, but it is not possible to establish a causality connection. The review of studies carried out by simulation with Australian drivers shows that the more signs and advertisement, the worse driving, although these results cannot simply be transferred to natural driving and the conclusion is that deeper research is needed in this field [9].

The effects of electronic boards on the road were analysed in Norway by means of filming. The following behaviours were analysed in more than three thousand vehicles: change of route, speed reduction and braking response. It was observed that most of the drivers respected the instructions given on the boards. However, it was also observed that in some cases, the speed reduction was due to the chain reaction caused by one vehicle braking and forcing the other vehicles to brake as well or to change lane in order to avoid colliding. This means that, despite the effectiveness of the electronic boards, we have to consider that the demand level can exceed the attention capacity of some drivers, especially in situations of high traffic density, causing hard braking manoeuvres and safety problems [19].

Road signposting plays an essential role to provide drivers with confidence in his/her orientation on the road. However, it can also have an influence on driver distraction when the signs cannot be read quickly and easily, thus demanding increased attention of the driver in order to decode the signs, having to lower his/her attention on the traffic and thus creating a distracting process.

Regulations currently in force lay down that the signs must have a certain size and typeface and that they must be located sufficiently in advance, considering the reaction times of a driver driving at a certain speed, but there are still several examples of necessary guiding information that do not comply with these requirements.

The requirements to be fulfilled by road signs in order not to be an element of distraction (due to their complexity or contradiction) for drivers are:

· Continuity: they must inform from the first time they appear until destination, and they have to appear in all decision-taking points of the trip in order to provide confidence to the driver.

· Coherence: they cannot contradict other signs giving way to doubts about the action to be carried out by the driver.

· Legibility: the board must show letters of an appropriate size to be read, considering that there are more and more 65-year-old and older drivers on the road, with reduced visual capacity.

· Positioning: they must be placed so that the driver can read them sufficiently in advance to take the decision without having to carry our brusque manoeuvres, considering the speed limit of the road.

· Repetitiveness: the information must be shown a reasonable number of times before having to take a decision to give the driver more than one chance to read the information, especially guiding information.

· Maintenance: worn signs, not reflective or with poor visibility due to vegetation, may imply a distraction factor for the driver.

Chapter 4

Distraction management

"Distractions while driving can be music, the telephone, passengers, a fly, a sneeze...anything, no matter how insignificant, can distract you. To concentrate, you have to feel physically well, with a quite clear mind and no worries."

Dani Sordo, rally driver

4.1 Introduction

Having analysed the features of distractions, their causes and consequences, an important question raised is the chance or ability of drivers to manage them. In other words, is it possible to learn not to get distracted, or at least, to limit the scope of distractions? Answering this question is an essential previous step to be able to propose possible solutions or possible mitigation strategies in order to tackle the risks implied by driving distractions.

A first, necessarily positive answer to this question stems from the definition made at the beginning of this report for the concept of distraction. There we insisted, that distractions respond to a voluntary reaction (although sometimes it might seem instinctive) of the driver to an internal or external stimulus that shifts his/her attention. If there is a will, it necessarily implies that distraction can be managed or at least its effects can be limited.

Beyond this confirmation, it is interesting to resort to an empirical observation, dealing with the different behaviour of a professional racing driver and a conventional driver. Although the former incurs in situations which entail much more risk, his driving style is usually much safer than the driving style of a conventional driver. Why? Why is the risk management ability of a professional driver much higher than that of a conventional driver?

This better ability is with no doubt - at least partly - connected to the fact that the vehicle of a professional driver includes state-of-the-art and evolved safety elements and that the races are held on closed circuits or racetracks, which are usually very safe. Obviously, the better driving technique of a professional driver plays a major role as well, like his skills and expertise at the wheel, compared to a conventional driver.

But when you ask professional drivers about the most important differentiating element as regards safety, compared to a conventional driver, the almost unanimous answer is the greater concentration ability, which is often associated to learning mechanisms that allow you to interiorise certain automatisms which are needed to drive well. This greater concentration ability and therefore the ability to not get distracted is maybe the most important factor when trying to explain why, considering the risks they take, their driving is safer than that of conventional drivers.

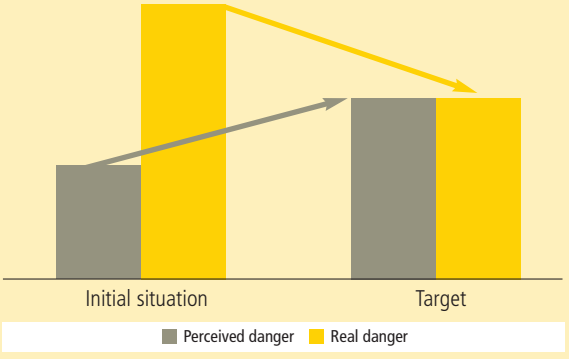
We will get deeper into this question in the following sections, highlighting possible recommendations to tackle the different distracting factors a driver may face while driving.

4.2 Unperceived risk and prevention of distractions

As we have repeatedly explained in previous sections, a very common problem of distractions is that drivers think that they occur with a much lower frequency than they actually do and therefore tend to underestimate their danger. This means that distractions are a big unperceived risk factor.

This underestimation of the risk has significant practical consequences. Since they are not fully aware of the danger involved in distractions and of their frequency, drivers tend not to take enough preventive measures, so that the objective probability for a distraction to occur increases significantly. In other words, the risk which is not perceived by drivers as regards distractions leads them to a relaxed attitude when taking preventive measures and eventually increases their real significance. This problem of unperceived risk is shown in Chart 3.

Chart 3. Perceived danger and real danger of distracting activities, current and targeted



Source: Own preparation

This chart also shows what should be the target of any strategy to manage distractions. In short, it is all about balancing the perceived and the real danger: if we increase the driver perception of danger associated to distractions, it is likely that they will engage less often in distracting activities, so the accident rate attributable to distraction will decrease.

In practice, the concept of risk or the unperceived (or insufficiently perceived) danger entails that any strategy to manage distractions must improve the prevention and awareness levels. The final target must be making drivers aware of the significance of distractions and the danger implied by their effects in order to make them take the necessary preventive measures that will allow them to minimise the problem.

Prevention and awareness are thus the two big elements when it comes to trying to mitigate the problems caused by distractions.

The prevention of distractions can be approached in a similar way to the medical model of illness prevention, raising three action levels: primary prevention, which would be avoiding distractions to happen; secondary prevention oriented towards detecting their appearance as soon as possible; tertiary prevention addressing all efforts to counteract, if possible, the negative effects of distractions that have already appeared, trying to avoid accidents and legal offences, for example, when the driver notices that he skipped the exit while talking to a passenger. The following sections will focus on primary and secondary prevention.

4.3 Primary prevention

The objective of primary prevention is to avoid distractions while driving. Primary prevention includes therefore all actions that avoid distractions from happening or significantly limit the probability that they will happen, as well as their consequences. Primary prevention must be understood in a wide sense, including at least three big concepts:

1. Prevention as such, which refers to actions aimed at avoiding distracting activities from happening. Due to their own nature, many of these actions must be carried out before starting a trip.

2. Concentration, understood as the capacity of drivers to focus their attention totally on the driving task, avoiding to engage in any other dual or secondary activity.

3. Anticipation, meaning the capacity of the driver to duly set the current situation in a context as well as the changes that may happen, including all those derived from other drivers.

These concepts intermingle in practice and it is often difficult to delimit them individually. But that does not prevent them from being configured as essential elements in any distraction prevention strategy.

Box 4.1. Preventive strategies to avoid or reduce distractions before starting off

Related to psychophysical and emotional states of the driver:

- Sleep the necessary hours at night.
- Take a short nap at noon.
- Do not eat heavy or fat-rich meals.
- Do not drink alcohol or take other drugs.
- Watch the secondary effects of medicines taken.
- Take a rest if you are physically or mentally tired.
- Calm down if you are emotionally altered.
- Agree to take turns at the wheel with passengers who have a license.

Related to distracting activities:

- Avoid having conversations that may end up in discussion with the passengers and stop any conversation when the traffic situation becomes potentially conflictive.
- Children and babies must be well seated or placed in their carrycots and duly fastened with CRS and safety belts.
- Use boxes to transport small animals, conveniently stabilised to avoid overturning or moving.
- Transport packages or bags if possible in the boot. If they are carried inside the car, place them on the floor, duly fitted to avoid movements or tumbling.
- Have your sunglasses, handkerchiefs and any other object you may need to use at reach.

4.3.1 PSYCHO-PHYSICAL AND EMOTIONAL STATES FAVOURING DISTRACTIONS

One of the most important elements in any primary prevention strategy is to give due importance to the psychophysical state with which the driver faces the driving task. As a general rule, before starting any trip, the driver must have slept the necessary hours, have had light, low-fat meals, not have drunk alcohol or taken any other drugs, be aware about the side effects of the medicines he/she is taking, take a rest until the physical or mental fatigue disappears and calm down if he/she is emotionally upset.

If these symptoms show up while driving, as a consequence of a long or monotonous trip, the driver has several alternatives that he may put in practice immediately. Many drivers feel bored, usually when driving becomes monotonous because of the lack of external stimuli (straight roads, with little traffic, at night, etc.), increasing the stimulation inside de car. They turn on the radio, talk to other occupants, smoke, eat chewing gum, refresh the air, etc. These actions have limited effectiveness. The best thing to do is to stop the car as soon as possible and to take a break. And in case of long trips it is obviously advisable to take turns with other passengers having a license.

When they feel sleepy, some drivers opt for totally inadvisable strategies such as, for example, increasing the vehicle speed [2]. They think that the sensation of a higher risk increases their activation level and therefore improves his/her attention [3]. But the risk of facing unexpected and potentially dangerous situations inadequately multiply as the vehicle speed increases, just like the tiredness derived from the higher tension implied by driving under these circumstances.

When attention reducing factors are emotional, such as nervousness, hurry, anger, fear, rage, etc. the driver must wait until he/she calms down before starting off, and during the trip, he/she has to avoid thinking about the situations that lead to these states of excitement. If nervousness is derived from the driving task as such, something quite usual among novice drivers [1], it is advisable to use easy relax strategies that will allow reducing the gathered excess of muscular tension.

Although negative feelings have a big perturbing capacity that may interfere with safe driving, the abundance of positive, highly intensive feelings (states of euphoria) can also lead to distractions due to excessive confidence and must therefore be avoided. The recent case of a 14-year old girl who was run over by the train in a guarded level crossing while talking on the mobile telephone, despite having a considerably sized red traffic light in front of her [6], is an example of "looking without watching" or inattention blindness [4], because the person is auditorily but especially cognitively focussed on the conversation.

In short we can say that in order to avoid the appearance of distractions, we should, on the one hand, be physically in good shape: healthy, without lack of sleep, correctly fed, under no drug effect, and on the other hand, free enough from any intense feeling of emotion, positive or negative.

4.3.2 DISTRACTERS AND DISTRACTIONS

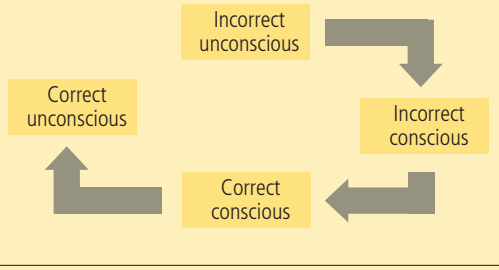
Common activities

As explained in other sections of this report, a large part of the most usual distractions incurred by drivers have their origin in very common activities and therefore are rarely considered as distraction generating activities. These activities include, among others, eating or drinking, looking for something in the glove compartment, changing a tape or a CD, looking after a young child or turning the head to watch closer something outside the car.

The suggestions to prevent these types of distractions before starting the trip are simple and easy: we must have the sunglasses, handkerchiefs, money or credit card to pay the tolls and any other thing we might need, at reach. Children must be correctly seated in CRS, pets must travel in their boxes, packages must preferably be placed in the boot, and if it is not possible on the floor of the car, duly fixed; beverages and food must be consumed while the car is stopped and the addresses of the places we are going to must be checked before starting the engine [4].

They are very simple actions, of common sense, easy to carry out and do not mean any significant effort for the driver. In practice, it is about adopting certain automatisms to change from a situation in which the driver is not aware of certain risks (and incurs in them) to another in which he/she corrects them automatically. Schematically, the learning of these automatisms would correspond to the phases shown in the following chart.

Chart 4. The process of interiorising behaviours in order to prevent distractions



Source: Own preparation

The benefits of these actions in terms of reducing distractions and accident risks are very important.

Passengers

On the other hand, we have to refer to the distracting power of other people on the driver and the way to manage it.

The relationship between driver and passengers is ambivalent. It is true that passengers can be a cause of distraction (looking after the children, having a heated discussion with other occupants of the vehicle, etc.), but it is also true that often the intervention of a passenger allows paying appropriate attention to the road (looking after the children, looking for and answering the telephone, etc. or even telling that the driver looks sleepy or tired and offering him/herself to drive for a while).

As regards conversations with other passengers, their distracting power has been compared to that of telephone conversations, regardless of whether they are with or without a hands-free set, since the heavy cognitive load can appear in all of the cases, without forgetting gesticulation and the visual and auditory sensorial implication that can go with these conversations. Thus it is estimated that when there are passengers on board the probability of having an accident increases, and the risk grows along with the number of passengers [5].

It is true, however, that in a complicated traffic situation passengers usually stop the conversation until it is over, which is not the case in a telephone conversation. Therefore, it is a good strategy to avoid conversations with passengers that might end up in an argument and, in any case, to stop talking in potentially conflictive traffic situations.

Box 4.2. Preventive strategies to avoid or reduce distractions related to technological devices

HANDHELD MOBILE TELEPHONE

- Make your calls before starting the trip, and tell that you are going to drive and the approximate duration of the trip.
- If you have passengers, the use of the mobile telephone must be restricted to the passengers. The driver must focus on the driving task.
- If you are driving alone it is preferable to turn it off. Turn it on and use it only when the vehicle is stopped.
- If you receive a call or an SMS, keep focussed on the driving task and look for a safe parking place to stop, park the vehicle and return the lost call.
- Using a handheld mobile telephone is prohibited by Law.

HANDS-FREE MOBILE TELEPHONE

Making a call

- Make your calls before starting the trip, and tell that you are going to drive and the approximate duration of the trip.
- It is better not to make any calls. But if it cannot be avoided, do it only while driving if you have a quick dialling feature and if the traffic condition allows you to do so.
- In any case, avoid making calls in the city and never send SMSs.

Receiving a call

- Before picking up, check the traffic situation.
- In complex situations do not pick up and proceed like in the case of a handheld mobile telephone.
- Tell the caller that you are driving.

The conversation

- Limit the duration of the conversation as much as possible.
- Leave complicated conversations that might create states of tension or euphoria for any other time.
- Do not manipulate the keys of the telephone to look for information or to send an SMS.
- Stay always focussed on the driving task.

AUDIO SYSTEM OR CD PLAYER

- Tune in to the preferred radio stations with the quick selection keys before starting your trip.
- Put the selected CD or CDs into the player before starting the trip.
- If you are driving alone, manipulate the system while the car is stopped.
- If you are accompanied, let the passenger manipulate the device while you are driving.
- It is better to have the controls included in the dashboard of the vehicle.
- It is better to have a multidisc CD-player since you won't need to change the CD so often.
- Keep the volume of the device on low or moderate levels.

NAVIGATION DEVICE

- The use of navigation devices needs training.
- Always enter data into the device when the car is stopped.
- It is better if the navigation device includes a feature that hinders the user from entering data while the vehicle is running.
- It is better to give voice instructions than enter them manually.
- Place the display of the navigation device in an easy visible place that won't force you look away from the road.
- The view over the road must be free.
- Leave the airbag spaces free.
- The support of the navigation device must not be close to the steering wheel or the gear lever.

Technological distracters

As regards technological distracters, the primary prevention strategy demands making a good use of them, in order to avoid possible distractions and to minimise the risk of having an accident. Before even starting the trip, we should programme the navigation device, tune in to the preferred radio station and introduce the CDs we want to listen to; we should not use the conventional mobile telephone in any case, and if we have a hands-free set, we should limit the number and duration of the calls as much as possible. The chart on the left shows some primary prevention advices for different technological devices.

It is interesting to highlight in connection with these devices, that it was observed that drivers do often carry out compensational behaviours, like for example slowing down, in order to reduce the risk implied by a distracting activity. These behaviours are not advisable since they change the usual speed of the vehicle creating confusion among the other drivers, so that it is better to stop the vehicle completely and then engage in the respective secondary activity.

4.4 Secondary prevention: Correcting distractions

The aim of secondary prevention is correcting distractions when they happen, helping the driver go get back to a normal driving state.

Because of its inherent nature, secondary prevention covers those devices that may help the driver to detect a distraction and, above all, to correct the effects in a more or less automatic way. There are many different types of devices. Some of them are already available on the market and others are still prototypes.

This type of technology applied to vehicles has been part of the automobile industry for many years, but it has made a qualitative step in recent years to become a helping element to correct potential consequences of driver distraction.

All of the technological developments which have been introduced in motor vehicles are grouped under the abbreviation ADAS (Advanced Driver Assistance Systems). Each of these systems is in turn defined by the abbreviation identifying its function. The aim of these systems is making the driving task easier and safer, and they are usually available as optional equipment, although as their safety potential becomes evident, they should be included as standard.

There are many different ADAS, but some of them provide a substantial added value in terms of avoiding that a distraction ends-up as an accident. Some examples:

· Advanced Cruise Control (ACC): keeps the vehicle speed constant and automatically applies braking if the vehicle gets too close to the preceding vehicle.

· Lane Departure Warning or Lane Keeping Assistant (LDW/LKA): warns the driver if the vehicle leaves the lane unintentionally.

· Blind Spot Monitoring (BSM): it warns the driver if there is another vehicle in the blind spot of his/her rear-view mirror.

· Driver Drowsiness Detector (DDD): detects and warns the driver in case of drowsiness.

· Seat Belt Reminder (SBR): warns the driver if he/she starts off without fastening the seat belt.

However, an essential aspect, on which there has been certain controversy due to its potentially distracting effect on drivers, is the way these systems communicate with the driver and the workload or stress that the fact of having so many technological systems that may send simultaneous messages can mean for the driver. Most of the manufacturers opt for an acoustic warning, although there are also systems that warn by means of a seat or steering wheel vibration or with a visual sign.

This question, also known as Human Machine Interface (HMI) is one of the most important aspects of the ADAS to be solved by the automobile industry in their constant technological innovation process in order to reduce the risks of driving.

Considering how new most of these devices are, there is little information yet about their effects on the mitigation of distraction effects.

Box 4.3. Preventive strategies to avoid or reduce distractions while driving

Related to psychophysical and emotional states of the driver:

- Keep a rather cool temperature inside the vehicle to help avoiding drowsiness.
- Stop every now and then to have some rest and do some exercise to tone up your muscles.
- Remember that meals during the trip should be light and that you should not drink alcohol.
- If you feel drowsy, stop and have a few minutes of sleep, have something to drink with caffeine or talk about insignificant things with the vehicle occupants.
- Avoid thinking about pending issues, family problems or any other topic that may make you become absorbed and shift your attention from driving.
- If you are bored, listen to radio stations that are automatically tuned in or keep trivial conversations with the occupants of the vehicle.

Related to distracting activities:

- Do not smoke inside the vehicle.
- Keep the windows closed to prevent insects from entering.
- Wait until you stop for a rest to eat or drink.
- Avoid engaging in any other activity that might distract you.

4.5 The role of institutions

Although the strategies to reduce distractions are quite simple, persuading drivers to change their behaviour is not an easy job [(4)]. It is a well known fact that changing habits which are already deep-rooted is very difficult, especially if they provide us with an immediate benefit. Therefore, any primary prevention strategy must be necessarily planned from a medium to long term perspective.

Public powers have with no doubt an important role to play in this strategy, at least by means of the following actions:

1. Education: The importance of distractions and the way to prevent them must be an explicit part of what new drivers must know to get their license.

2. Awareness: Carrying out information campaigns about the dangers involved in distraction is essential to make drivers aware of the need to take preventive measures that will help them to avoid distractions and to minimise the accident risk[4].

3. Encouragement: The Administration should support R+D programmes making it easier to develop ADAS and possibly encourage their implementation in vehicles by means of tax incentives. This tax incentive might imply eliminating the registration tax which is applicable to the value of these devices which are part of the final price of the vehicle.

4. Improvement of infrastructures: It is necessary that the Administration fits the roads with the already available systems that allow reducing or correcting distractions. These devices include for instance recommended speed warning systems at bends, or rumble strips on roadsides warning drivers when they are leaving the lane.

5. Roadside advertising: Although it is true that roadside advertising has been reduced a lot in recent years, limiting them to urban and metropolitan environments, it is also true that there are frequent cases in which due to different reasons (inadequate location, excessive concentration, abusive lighting, etc.) hoardings become significant distracting elements. In these cases, the administrations in charge (central, autonomous or local) should take the necessary corrective measures, not ruling out the possibility of banning advertisement in certain places.

6. Review of the signposting: Available surveys show that bad signposting is one of the matters pending in mobility and, particularly, in Spanish road safety. A much more active policy from the administrations in charge is urgently needed, in order to achieve a simple, clear and safe signposting.

7. Review of the Law on Road Safety: An interesting way to give an answer to many of the questions raised in this report would be to include a specific section on distractions in the Law on Road Safety, linking the compulsoriness to pay permanent attention to the driving task to the different preventive strategies mentioned above.

4. In recent months, both the Spanish and the Catalan Traffic Authorities have carried out campaigns in this sense. In both cases there have been high-quality and very innovative campaigns. But there is still a big margin of action, especially considering the large amount of campaigns that have already been carried out (and the new results achieved) with respect to alcohol consumption or speeding, which are risk factors with a lower significance in terms of accident rates than distractions.

Conclusions

"The best advice I can give to drivers is to always keep a margin: if you are driving at a 90%, no way. A lady with a baby trolley may suddenly appear in front of you and you may not have time enough to avoid it. If you have a 50% margin you will still have a chance to react."

Jorge Lorenzo, motorbike rider

Throughout this document we have described to what extent distractions can cause road accidents or have an influence on them. We have explained the typology of distractions and the most frequent distracting elements in detail. Moreover, we have given advice on how to avoid them, prevent them or correct them.

What most surprises is, however, that this document is not only based on national and international data, surveys and academic bibliography, but also on something very simple: common sense. What's more, the reader of these pages might even think that we are not explaining anything new and that we are simply describing details of routines or usual bad driving habits. And this is the real background of the problem there is with distractions: anybody can understand that they exist, but it is difficult to become aware of how much they can affect you.

If, as we have explained and documented, distraction is a concurrent factor in one third of all road accidents, and drivers still underestimate their significance in connection with the road accident rate, it becomes evident that we are facing a problem.

It is essential to become aware of and to perceive the real risk of distractions, a risk no driver is immune to. If we go back in time a few years we will be able to see, for instance, how we have managed to change the attitude of drivers as regards questions such as the use of safety belts, appropriate children restraint systems or the significance of not driving after having had alcohol. A change of attitude like this is also needed as regards distractions.

It is essential that the industry does research into it and creates new devices to avoid or mitigate the effects of distraction. Institutions must also play their role, supporting the establishment of these devices in the market, improving infrastructures, as well as educating and making people aware of their importance. But it is the drivers who have the last word about it: It is them who have to use common sense and consider driving as an activity needing full attention.

This attention must be fed with three essential elements: prevention, concentration and anticipation. Prevention being understood as all those actions that help you to avoid or to reduce distractions before even starting off or while driving; concentration understood as the dedication of all your senses, without exceptions, to the driving task; and anticipation understood as a state of alert that will help you to never lower your guard and to not only avoid and correct your own distractions but also the possible consequences of the distractions of the drivers around you.

In one of the conversations held by the RACC Foundation with professional drivers about this topic, Pedro Martínez de la Rosa said: "Unfortunately, there is a lot we can learn about accidents. Racing accidents have taught me how to not get distracted in order to avoid them. But on the road, you might have an accident and it might be the last one: you won't be able to learn anything."

Therefore, the key is to create a state of opinion giving the deserved importance to the problem of driving distractions. This is the only way to reduce them, and consequently to reduce road fatalities even more.

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