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# **Road safety and driving behaviour: a comparison between the USA, France and Germany**

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## **Acronyms**

ADAS	Advanced Driver Assistance Systems
CDC	Center for Diseases Control and Prevention
DBQ	Driver Behaviour Questionnaire
DMV	Department for Motor Vehicles
DOT	Department of Transportation
FHWA	Federal Highway Administration
IRTAD	International Road Traffic and Accident Database
NHTSA	National Highway Traffic Safety Administration
OECD	Organisation for Economic Co-operation and Development
UNECE	United Nations Economic Commission for Europe
WHO	World Health Organisation

## **Introduction**

The automobile has experienced numerous changes throughout different periods of time. To set the exact date of the world's first automobile and point out a single engineer is a difficult task. Overall, experts have agreed that the three-wheeled motor patent car *Motorwagen* created by Karl Benz in 1886, was the world's first modern automobile<sup>1</sup>. The meaning of the words "car" and "automobile" has developed alongside automobile history. In the 19th century, a car was a streetcar, known before that as a horse car which was an omnibus pulled by horses on rails. "Automobile" comes from the Greek *autos*, meaning "self" and the French *mobile* stands for "moving"<sup>2</sup>. These words depict a self-moving vehicle that enables its users to go from point A to point B.

In the last few years, scandals of inappropriate speeding to beat the record on the world's famous German *Autobahn* have stormed the news. In July 2021, Radim Passer, a Czech millionaire, posted a video on Youtube driving at 259 miles per hour (416.8 km/h) on a section without a speed limit and caught the attention of German authorities<sup>3</sup>. The car he was driving, the Bugatti Chiron supersport 300+, proved to be the fastest commercialised car in the world in 2022 and reaches a top speed of 304.7 miles per hour<sup>4</sup>. Cars have become more than just a means of transportation. For instance, car shows are no longer only famous amongst speed lovers and car enthusiasts and have become mainstream. The importance of driving and owning a car has different meanings across worldwide cultures.

The USA, France and Germany, the three main historical car manufacturers in the world, have culturally different relationships towards cars. Driving in the United States of America is a synonym for freedom and independence<sup>5</sup>. The car is one of Americans' favourite transportation means and hulking SUVs and pickups are the most bought cars<sup>6</sup>. In Germany, the car is also really important and the culture around it is of greater significance than in other countries<sup>7</sup>. It is also stated that the car culturally indicates the social status of a person. In France, cars have been part of the country's culture for a long time and as President

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<sup>1</sup> Cox Lauren, "Who invented the car", Live Science, March 25 2022, p.2

<sup>2</sup> "Automobile", Online Etymology Dictionary, Etymonline, p.1

<sup>3</sup> "Real estate magnate Radim Passer facing prison time after reaching 417 km/h on German Autobahn", 7 News, February 9 2022, p.2

<sup>4</sup> Allan Matt, "What is the fastest car in the world 2022? Road cars with highest top speeds-SSC Tuatara to Bugatti", National World, November 16 2022, p.13

<sup>5</sup> Moeckli Jane, D. Lee John, "The making of driving cultures", University of Iowa, 2007, p.1

<sup>6</sup> DeBord Matthew, "This car symbolises why France and the US have completely different driving cultures", September 29 2016, p.3

<sup>7</sup> Taylor Cathy, "About German Culture", Classroom, September 29 2017, p.1

Pompidou said in the early 1970s: “the French love their cars”<sup>8</sup>. However, it is known that French people will prefer to spend their money on other items before spending it on their cars<sup>9</sup>.

Since the automobile was created, the original vehicle has changed dramatically, and now has little in common with its original ancestor. The many technical and aesthetic changes respond to safety needs and overall expectations of the worldwide population over time. There is now a large number of different self-moving vehicles, from the overall conventional cars to the more recent alternative-energy vehicles, like hybrid and electric cars that have taken over a large share of the global automobile market.

Roads bring together drivers, pedestrians, and cyclists, and can therefore result in extremely dangerous situations for all of its users. The implementation of several measures by worldwide governments has lowered the share of road crash fatalities over the years. Speed enforcement, such as speed limits and speed cameras, and the construction of safer infrastructures have participated in making roads safer. In 2017, the compulsory wearing of a seat belt saved approximately 14,955 lives in the USA<sup>10</sup>.

But injuries and deaths in road traffic crashes still represent a major global concern. According to the World Health Organisation, 1.35 million people are killed each year on roadways around the world<sup>11</sup>. Reckless driving attitudes such as speeding and driving under the influence of alcohol and psychoactive substances are one of the main factors for car crashes<sup>12</sup>. The problem of excessive speed can be addressed with safer infrastructure and driver education<sup>13</sup>.

Just as American, French and German people have different attitudes towards cars generally, they also have culturally different approaches regarding driver’s education and safety on the roads.

My research dissertation will attempt to answer the following questions on road safety and driving behaviours. How does culture influence drivers’ behaviours? To what extent do road safety education and culture have an impact on road safety? Why is the intervention of governments and institutions highly essential to improve safety on the roads? In order to answer these questions, I will analyse the status of road safety in these three countries.

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<sup>8</sup> Normand Jean-Michel, “France falls out of love with the car”, November 9 2014, p.2

<sup>9</sup> Ibid., p.2

<sup>10</sup> “Seat belts”, NHTSA National Highway Traffic Safety Administration, p.3

<sup>11</sup> “Road Traffic Injuries and Deaths - A Global Problem”, CDC Centers for Disease Control and Prevention, December 14 2020, p.2

<sup>12</sup> “Road Traffic Injuries”, June 20 2022, World Health Organisation, p.2,3

<sup>13</sup> Ibid., p.2

Secondly, I will look at the cultural differences in driver education and driving behaviour.

Thirdly, I will look at the various tools implemented to improve safety on the road.

## **Part I. Road Safety Status**

### **Chapter 1 - Road Crash Fatalities and Injuries**

“Injuries caused in transit are the world’s eighth cause of death and the first among young people from 15 to 29 years of age”<sup>14</sup>. Experts are going even further than that. If the situation does not improve, they predict that by 2030, road traffic accidents will become the fifth leading cause of mortality worldwide. This statement was issued in the 2013 Global Status Report on Road Safety Situation by the World Health Organisation. The number of road deaths reported in 2018 underlines the importance of improving safety on the roads. The figures reached 35,092 in the USA, 3,206 in Germany and 3,477 in France<sup>15</sup>. The report clearly illustrates that road safety remains a global problem that has to be taken seriously and urgently dealt with by governments and institutions.

In this chapter, I will examine the road safety status in the three countries. My analysis will cover the different driving behaviours during the coronavirus pandemic and the attitudes of drivers concerning the use of seat belts.

#### *The coronavirus pandemic*

I will analyse the impact of the coronavirus pandemic on road fatalities and different driving behaviours. The global coronavirus pandemic has shown how mobility and transportation were heavy indicators in worldwide traffic deaths. In 2020, governments in countries all over the world began to enact severe freedom restrictions that directly impacted the mobility of their populations<sup>16</sup>. Data from March and April 2020 highlighted the correlation between traffic volumes and the casualties they were responsible for<sup>17</sup>. In 11 IRTAD nations<sup>18</sup>, including France and Germany, traffic volumes were overall 12.2% lower in 2020 compared to the years 2017 and 2019<sup>19</sup>. In France, they even decreased by 17.8%<sup>20</sup>. The lowest share of traffic volumes was observed during April and May 2020 and the numbers decreased

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<sup>14</sup> “Road safety that’s obvious and helps lives”, On the road trends, September 6 2021, p.1

<sup>15</sup> “Global status report of road safety around the world”, WHO, 2018, p.259, 151, 147

<sup>16</sup> “Road Safety Annual Report 2021”, International Transport Forum, OECD publishing, 2021, p.8

<sup>17</sup> Ibid., p.8

<sup>18</sup> International Traffic Safety Data and Analysis Group (IRTAD) is the permanent working group for road safety of the International Transport Forum.

<sup>19</sup> “Road Safety Annual Report 2021”, op.cit., p.22

<sup>20</sup> Ibid., p.22



respectively by 32% and 25% compared to the average numbers between 2017 and 2019<sup>21</sup>. This naturally led to a drop in traffic volumes and therefore also to a decrease in traffic victims.

On average, traffic mortality numbers decreased by 8.6% across the 34 IRTAD nations<sup>22</sup>. A significant downward trend was observed between March and May 2020<sup>23</sup>. This can be explained by the early stage of the pandemic and the strict lockdowns. In 2020, traffic casualties decreased by 21.7% in France, compared to the previous year with an estimate of 2,541 road fatalities<sup>24</sup>. The same year, Germany had 2,719 road deaths, a slightly higher number than France, and a 10% decrease compared to 2019<sup>25</sup>. This clearly shows the correlation between traffic volumes and traffic casualties. However, it is essential to take into account the existing disparities between nations, particularly with regard to demographics, traffic volumes and overall cultural driving behaviours.

The United States of America is the exception to this broad pattern and fails to confirm this trend. With a population of 330 million citizens, the United States makes up around 40% of all IRTAD nations' traffic deaths and has a significant impact on the global average<sup>26</sup>. The United States of America did not experience the same trend during the coronavirus pandemic. Instead, the country showed the opposite trend and accounted for the highest number of road deaths in all 34 ITRAD countries. As the road fatalities decreased in France and Germany for example, in the USA the number of traffic victims increased by 18.4% from the first half of 2020 until the first half of 2021<sup>27</sup>. The number of fatalities rose and reached its highest peak since 2006, with an estimated number of 20,160 traffic victims<sup>28</sup>. "We cannot and should not accept these fatalities as simply a part of everyday life in America," said Pete Buttigieg, transportation secretary in a press release<sup>29</sup>. In comparison, France reached its fatality peak in 1972, with an estimated 18,000 road casualties<sup>30</sup>. This is why the French government undertook a great number of measures between 1990 and 2000, aiming at lowering casualties on the roads<sup>31</sup>. During the decade, as traffic volumes increased, the number of road victims

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<sup>21</sup> Ibid., p.23

<sup>22</sup> Ibid., p.23

<sup>23</sup> Ibid., p.26

<sup>24</sup> "Road Safety Report 2021, The Impact of Covid-19 France", International Transport Forum, OECD, p.2

<sup>25</sup> "Road Safety Report 2021, The Impact of Covid-19 Germany", International Transport Forum, OECD, p.2

<sup>26</sup> "Road Safety Annual Report 2021", op.cit., p.27

<sup>27</sup> "Road fatalities increased and transit ridership dipped", U.S. Government Accountability Office (GAO), January 25 2022, p.1

<sup>28</sup> Ibid., p.1

<sup>29</sup> "USDOT releases new data showing that road fatalities spiked in first half of 2021", U.S. Department of Transportation, October 28 2021, p.1

<sup>30</sup> "Road Safety Report 2021", France, op.cit., p.2

<sup>31</sup> Ibid., p.2

decreased by 20%<sup>32</sup>. It was really between 1990 and 2020 that the number was considerably reduced, by 72%.<sup>33</sup>

Government restrictions to lower the number of coronavirus infections led to a change in driving behaviours in the USA. Empty roads led to more cases of reckless driving than before the pandemic<sup>34</sup>. Drivers engaged in speeding, driving under the influence of alcohol and other drugs, and non-seat belt use<sup>35</sup>. These are some of the main causes of road deaths in the history of the United States and also in other countries. A survey from 2020 questioning 500 Americans has brought to light the behaviour of American drivers during the coronavirus pandemic. 11% recognised exceeding the speed limit by at least 20 miles per hour more often than usual in the early months of the pandemic<sup>36</sup>. 66% of the drivers exceeded speed limits because of the emptiness on U.S. roads<sup>37</sup>. 46% thought that being a “good driver” would permit them to drive safely even at higher speeds<sup>38</sup>. 34% of them drove above the speed limit because there was a low presence of police enforcement<sup>39</sup>. But speeding, even a few miles over the speed limit, can change everything. In 2020, 29% of all crash fatalities were linked to speeding<sup>40</sup>. Speed management is an effective way to lower the risk of fatal accidents. In France, inappropriate or excessive speed is the main factor in deadly collisions. In 2020, speed was one of the reasons for 29% of fatal crashes and was the main factor in 19% of fatal collisions in France<sup>41</sup>. In Germany however, inappropriate speeding is often reported with other risk factor behaviours such as drink-driving for example<sup>42</sup>. In 2020, it was responsible for 33.7% of fatal crashes<sup>43</sup>. Impaired driving and driving under the influence of drugs and other psychoactive substances can alter the driver’s perception of danger and increase the time for anticipation. In 2020, 30% of all traffic victims involved an alcohol-impaired driver in the USA<sup>44</sup>.

The Center for Diseases Control and Prevention, CDC, revealed that substances other than alcohol are implicated in 16% of road traffic accidents<sup>45</sup>. In France, the number of

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<sup>32</sup> Ibid., p.3

<sup>33</sup> Ibid., p.2

<sup>34</sup> “Road Safety Annual Report 2021”, op.cit., p.13

<sup>35</sup> Ibid., p.13

<sup>36</sup> Raychel Adiutori, “Survey: the top 5 reasons why drivers speed (2021)”, Erie Insurance, October 21 2021, p2

<sup>37</sup> Ibid., p.2

<sup>38</sup> Ibid., p.2

<sup>39</sup> Ibid., p.2

<sup>40</sup> “Speed”, Insurance Institute for Highway Security, July 2022, p.2

<sup>41</sup> “Road Safety Report 2021”, France, op.cit., p.5

<sup>42</sup> “Road Safety Report 2021”, Germany, op.cit., p.5

<sup>43</sup> Ibid., p.5

<sup>44</sup> “Transportation Safety”, The Center for Disease Control and Prevention, December 28 2022, p.1

<sup>45</sup> “Road fatalities increased and transit ridership dipped”, op.cit., p.1

alcohol-related fatalities has been constant and around 30% since 2000<sup>46</sup>. In the United States, driving under the influence of alcohol, drugs and other psychoactive substances during the pandemic increased the number of casualties. Between mid-March and mid-July 2020, approximately two-thirds of the severely or fatally wounded drivers tested positive for active substances, including alcohol, marijuana, and opioids<sup>47</sup>. Compared to the prior six months, the percentage of drivers who tested positive for opioids roughly quadrupled after mid-March 2020, while marijuana use climbed by around 50%<sup>48</sup>. Given that the rise in marijuana use coincides with changing social attitudes and laws about marijuana consumption in the USA, it may not be entirely due to the pandemic<sup>49</sup>.

Another change in drivers' behaviour observed after the coronavirus pandemic in the USA, was the non-use of seat belts. The National Highway Traffic Safety Administration, NHTSA, reported that 51% of passenger victims did not use their seat belts in 2022 in the USA. This is 4% more than in 2019<sup>50</sup>. The risk of death and severe injuries for rear seat occupants is reduced by 25%, whereas the risk of death and serious injuries for front seat occupants is reduced by 45 to 50% when wearing a seat belt<sup>51</sup>. In 2021, France had the highest rate of seat belt use among OECD countries<sup>52</sup>. In Germany, the rate reached 98% in 2020<sup>53</sup>. This shows that drivers as well as their passengers have acknowledged the importance and the undeniable role of wearing a seatbelt plays to save lives when involved in a crash.

### *The use of seat belts*

Wearing a seat belt in the United States, France and Germany is part of the law. In all three countries, drivers are responsible for their passengers under the age of 18 and will have to pay a fine if they are not restrained. The compulsory requirement backed up by a fine, has been a major factor in changing drivers' behaviour towards the use of seat belts.

However, drivers have not always welcomed this security measure with the same willingness. Before seat belts became the norm, drivers globally were reluctant when it came to wearing a seat belt. Germans and Americans first saw them as a freedom restriction. In the United

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<sup>46</sup> "Road Safety Report 2021 France", op.cit., p.6

<sup>47</sup> "Continuation of Research on Traffic Safety During the COVID-19 Public Health Emergency: January-June 2021", Behavioral Safety Research, NHTSA, October 2021, p.1

<sup>48</sup> Ibid., p.1

<sup>49</sup> Ibid., p.10

<sup>50</sup> "Seat belts", NHTSA, p.2

<sup>51</sup> "Road Traffic Injuries", World Health Organisation, June 20 2022, p.3

<sup>52</sup> "Road Safety Report 2021 France", op.cit., p.8

<sup>53</sup> "Road Safety Report 2021 Germany", op.cit., p.6

States, wearing a seat belt has been controversial since its creation. In 1968, 14% of Americans wore their seat belts, even though lap and shoulder seat belts were mandatory in all new cars<sup>54</sup>. At that time, reluctance was the norm when it came to seat belts<sup>55</sup>. In 1973, the NHTSA tried to issue an interlock mechanism to stop the car from starting if the driver was not buckled up, and was strongly criticised by the population<sup>56</sup>. After having received a great number of letters of complaints, Congress decided in 1974 not to pursue the implementation of this mechanism and reduced the buzzing sound effect to eight seconds<sup>57</sup>. During that time, government intervention was not welcomed by Americans who saw it as a restriction of their freedom in a free society<sup>58</sup>. In 1977, the NHTSA adopted a rule on a “passive restraint system” belt that was harshly pushed away by the new administration in charge<sup>59</sup>. Ronald Reagan, the president of the United States at that time, had won the presidency on a campaign of deregulation with a strong emphasis on the car sector<sup>60</sup>. The case was taken all the way up to Congress, which ruled in favour of the NHTSA<sup>61</sup>. As of August 2020, New Hampshire remained the only state that does not require adults to use seat belts<sup>62</sup>. The percentage of people wearing a seat belt, therefore plateaued at 70% and is lower than in Germany and France<sup>63</sup>.

German drivers have also questioned the safety of this new technology and argued that the device had not sufficiently proven its effect on the drivers' safety<sup>64</sup>. It was not until 1984 when driving without a seat belt became punishable by a fine of 40 *Deutschmark*, that the rate rose from 60% to 90%<sup>65</sup>. In Germany, lap belts were formerly permitted in the back seat, but starting in 2004, three-point belts were required for all seats<sup>66</sup>. During the year 1972, 18,034 people got killed on the roads in France. As a result, wearing a seatbelt became a compulsory requirement in 1973 in France for front seat users when driving outside agglomerations and saved 3,500 people<sup>67</sup>. This measure became mandatory at night on all

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<sup>54</sup> Roos Dave, “When Americans resisted seat belt laws”, History Stories, August 31 2020, p.1

<sup>55</sup> Ibid., p.1

<sup>56</sup> Ibid., p.1

<sup>57</sup> Ibid., p.2

<sup>58</sup> Ibid., p.1

<sup>59</sup> Ibid., p.2

<sup>60</sup> Ibid., p.2

<sup>61</sup> Ibid., p.2

<sup>62</sup> Ibid., p.3

<sup>63</sup> Ibid., p.3

<sup>64</sup> “Three-point safety belt”, German Patent and Trade Mark Office, November 7 2022, p.2

<sup>65</sup> Ibid., p.2

<sup>66</sup> Ibid., p.2

<sup>67</sup> Boréan Yannick, “Sécurité routière : Il y a 40 ans, la ceinture de sécurité devenait obligatoire à l'avant des véhicules”, France Bleu, October 1 2019, p.2

types of roads in 1975<sup>68</sup>. But it was really in 1990 that wearing a seat belt became mandatory, for both front and rear passengers<sup>69</sup>. It took another ten years to implement the seat belt warning requirement in all new vehicles in the European Nation<sup>70</sup>.

The laws regulating the wearing of a seat belt differ between Germany and France, and the United States. The USA for example, has primary and secondary seat belt laws<sup>71</sup>. The first one allows the police to issue a fine directly to the driver or passenger for failing to use a seat belt<sup>72</sup>. The secondary law only allows the police to give a ticket if another traffic infringement offence was made<sup>73</sup>. As of April 2021, primary seat belt legislation for front-seat occupants is present in 35 states<sup>74</sup>. In 15 states, the primary law applies to younger drivers and passengers, while the secondary law only applies to adults who are front seat passengers<sup>75</sup>.

In this chapter, we have seen the differences in compliance with the law and the impact of the pandemic on drivers' behaviour. Another important difference between the three countries relies on the road network and its infrastructure. The design of infrastructure influences drivers' behaviour and plays an important role in the safety of road users.

## **Chapter 2 - Road Infrastructure: The Case of Roundabouts**

In this chapter, I will now discuss the cultural differences in road infrastructure. The design of the road network has an impact on road safety and is an important characteristic to keep all road users safe<sup>76</sup>. It is argued that all road users, from pedestrians to cyclists and motor vehicles, should have at their disposal adequate infrastructure that guarantees their safety. This implies “footpaths, cycling lanes, safe crossing points” for example<sup>77</sup>. These infrastructures are developed in the USA, France and Germany, but the countries have chosen different infrastructures for their roads. To present the problem of infrastructure, I will take the case of roundabouts and compare it to traditional signalised intersections. This will allow me to analyse safety differences between the countries.

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<sup>68</sup> Ibid., p.2

<sup>69</sup> Ibid., p.2

<sup>70</sup> “Three-point safety belt”, op.cit., p.2

<sup>71</sup> “United States”, OECD, International Transport Forum, Irtad Road Safety Data, p.8

<sup>72</sup> Ibid., p.8

<sup>73</sup> Ibid., p.8

<sup>74</sup> Ibid., p.8

<sup>75</sup> Ibid., p.8

<sup>76</sup> “Road Traffic Injuries”, op.cit., p.3

<sup>77</sup> Ibid., p.3

### *Roundabouts and traditional intersections*

Traditional signalised intersections are present in all three countries. Roundabouts on the other hand have not been popularised in the same way depending on the country. Traffic circles, also known as modern roundabouts, were designed to offer safer roads and improve traffic flow around a central point<sup>78</sup>. They both have the same infrastructure but differ in yield at entry rules. Roundabouts and traffic circles have largely overtaken the French landscape<sup>79</sup>. Overall, these infrastructures are known to make roads safer as they force drivers to slow down before entering traffic. The in-circle infrastructure does not allow drivers to drive at high speed within the roundabout. This represents another factor that increases safety<sup>80</sup>. Roundabouts have also been proven to reduce conflicts as the drivers become more aware of the traffic when they reduce speed before entering the traffic circles<sup>81</sup>. On the other hand, traffic light intersections present higher risks of frontal conflicts because of the numerous perpendicular directions<sup>82</sup>. Furthermore, traffic light intersections are known to encourage drivers to pass through the yellow light quickly to get across the intersection<sup>83</sup>. Crashes occurring on roundabouts are considered to be minor accidents and less fatal compared to crashes at intersections, as they offer only give way to the right when exiting<sup>84</sup>. In France in 2015, less than five accidents occurred per 100 roundabouts per year. This is ten times less than in the 1990s<sup>85</sup>.

Roundabouts are more famous in European countries than in the United States. The biggest roundabout in Europe is the famous *Place de l'Etoile* in Paris, France, which dates back to 1906<sup>86</sup>. The first modern traffic circle was allegedly implemented in Germany in 1899 and in the USA in 1905<sup>87</sup>. France is known to be the country with the most traffic circles<sup>88</sup>. In fact, the number of roundabouts has flourished from 500 to more than 30,000 over the past 20

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<sup>78</sup> Ibid., p.1

<sup>79</sup> Breeden, A., "Traffic Circle are Everywhere in France", NY Times, December 25 2019, p.1

<sup>80</sup> "Roundabouts: A Direct Way to Safer Highways", Vol. 59 No. 2, Federal Highway Administration, Autumn 1995, p.2

<sup>81</sup> Ibid., p.2

<sup>82</sup> Ibid., p.2

<sup>83</sup> Ibid., p.2

<sup>84</sup> Ibid., p.2

<sup>85</sup> Scrase R., "Case 5 Circle of Influence", Europa, p.2

<sup>86</sup> Thomas Martin, "Le rond-point, une histoire française née à Paris", ActuParis, 7 August 2022, p.2

<sup>87</sup> "Case 5 Circle of Influence", op.cit., p.3

<sup>88</sup> Metz Justin, "Everything you've ever wondered about roundabouts", Erie Insurance, September 14 2022, p.3

years in France<sup>89</sup>. Estimation suggests that the country adds more than 1,000 roundabouts to its road network every year<sup>90</sup>. The main reason for this change in the French road network is simply safety. In Germany, roundabouts account for 168 and in the USA 73 per one million inhabitants<sup>91</sup>. This clearly shows that France has the most roundabouts on its roads compared to Germany and the USA.

But if roundabouts are safer than traditional traffic light intersections, why are the USA and Germany reluctant to make them a bigger part of their landscape? Studies have shown that roundabouts are overall safer than traffic light intersections. However, exceptions exist. German and American institutions have raised their concern about the functioning of roundabouts. They are afraid that not everyone is familiar with such infrastructure and might have trouble getting across them correctly<sup>92</sup>. A recent satellite video image showing drivers confusingly entering traffic on a new roundabout in the USA, resulting in blocking the traffic completely, reinforced the concern<sup>93</sup>. Another example is the roundabout at *Place de l'Etoile*, located in Paris. It is the worst nightmare for foreigners driving in the French capital. Even French people feel overwhelmed when they have to drive through this twelve traffic artery infrastructure, with a change in right-of-way rules (drivers already in the roundabout have to yield the way to drivers entering the traffic)<sup>94</sup>. It is such a massive and confusing infrastructure that student drivers are not allowed to enter the roundabout for practise<sup>95</sup>. In the United States, one year after the complete construction of a multi-lane roundabout near Bellingham, Washington, drivers exposed problems in understanding speed enforcement and the rules of right of way<sup>96</sup>. However, the Federal Highway Administration, FHWA, is willing to build new roundabouts, which are recommended as “one of 20 evidence-based safety countermeasures” recommended by the administration in 2017<sup>97</sup>. The states of New York and Virginia have voted for the “roundabout first” policies, respectively in 2011 and 2009,

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<sup>89</sup> “Case 5 Circle of Influence”, op.cit., p.1

<sup>90</sup> Ibid., p.2

<sup>91</sup> Ibid. p.1

<sup>92</sup> “Driving around in circle”, op.cit., p.1

<sup>93</sup> Robert Stumpf, “Chaos Erupts Immediately After Northeast Kentucky Gets Its First Roundabout”, April 26 2021, The Drive, p.1

<sup>94</sup> “Le cas particulier de la place de l'Etoile”, Euro-Assurance, December 17 2015, p.1

<sup>95</sup> Ibid., p.2

<sup>96</sup> “Roundabouts”, IIHS, July 2022, p.5

<sup>97</sup> Ibid., p.2

requiring that roundabouts should be chosen to build new road infrastructure or renew older ones<sup>98</sup>.

### *Roundabouts and vulnerable users*

Overall, traffic circles are drastically reducing conflict points, thus reducing significantly vehicular crashes<sup>99</sup>. However, the safety of vulnerable users such as pedestrians and cyclists on roundabouts also needs to be discussed. In Germany as well as abroad, small roundabouts outside of built-up areas are acknowledged as particularly safe traffic structures<sup>100</sup>. However, in places with a lot of traffic conjecture, safety issues can be observed, especially for cyclists<sup>101</sup>. Research conducted by the German Insurance Association analysed videos of ten roundabouts in Germany over five hours, to observe the behaviour of both drivers and cyclists. The observations concluded that drivers respected the right of way of cyclists<sup>102</sup>. However, the highest rate of accident risk for cyclists is found in roundabouts with bike paths around the perimeter that gives them priority over drivers entering and exiting the roundabout<sup>103</sup>.

The FHWA Roundabout Design Guide argues that low speed on roundabouts offers safety for pedestrians<sup>104</sup>. A pedestrian hit by a vehicle going under the 20 miles per hour speed limit of a roundabout has a 15% chance to succumb from their injuries<sup>105</sup>. The percentage rises from 45% to 85% on a conventional intersection with a speed limit of 30 to 40 miles per hour<sup>106</sup>. In France, according to statistics from 2015, incidences involving pedestrians on modern roundabouts are much lower than on other intersections<sup>107</sup>. But the proportion of fatally injured pedestrians is 0.3% higher in comparison to the 3.1% for intersections<sup>108</sup>. In 2005, on all 24,000 French urban roundabouts, 131 accidents happened involving pedestrians, which represents one accident for roughly 170 roundabouts, and only seven pedestrians were

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<sup>98</sup> Ibid., p.2

<sup>99</sup> Stone, J.R., Chae, K., Pillalamarri, S., “The Effects of Roundabouts on Pedestrian Safety”, August 2002, p.2

<sup>100</sup> “Safety at roundabouts in built-up areas”, Compact accident research, No.36, German Insurance Association, February 2013, p.1

<sup>101</sup> Ibid., p.1

<sup>102</sup> Ibid., p.14

<sup>103</sup> Ibid., p.11

<sup>104</sup> “The effect of roundabouts on pedestrian safety”, op.cit., p.3

<sup>105</sup> Ibid., p.3

<sup>106</sup> Ibid., p.3

<sup>107</sup> “Case 5 Circle of Influence”, op.cit., p.2

<sup>108</sup> Ibid., p.2



killed<sup>109</sup>. The infrastructure of roundabouts also affects the accident risk for pedestrians. Single-lane roundabouts have proved to generate fewer crashes involving pedestrians than multi-lane roundabouts<sup>110</sup>. This is due to the degree of complexity of crossing these infrastructures for pedestrians. Indeed, pedestrians can find it more difficult to cross at multi-lane roundabouts than at single-lane roundabouts<sup>111</sup>. According to one study, drivers disregarded two to three times more frequently the right-of-way for pedestrians in multi-lane roundabouts than at single-lane roundabouts<sup>112</sup>. Another study showed that drivers entering a roundabout were more likely to yield to pedestrians than drivers exiting traffic<sup>113</sup>.

In this chapter, we have seen that roundabouts create fewer conflict points than traditional intersections, and are overall safer for all road users. However, the design of roundabouts can alter the safety of its users. This is why these infrastructures need preventative measures to enhance how drivers, pedestrians and cyclists behave<sup>114</sup>.

### **Chapter 3 - Vulnerable Users**

Vulnerable users are defined as non-motorised road users, such as pedestrians and cyclists, persons with disabilities or reduced mobility and orientation, and motorcyclists<sup>115</sup>. According to the World Health Organisation, vulnerable users account for more than half of all road traffic deaths, and 23% of them are pedestrians<sup>116</sup>. The USA and France account for the same percentage of 15.3% pedestrian deaths of all deaths on the road<sup>117</sup>. Germany stands out with 16.1% of pedestrian deaths of all road user categories<sup>118</sup>. It is important to take the overall number of motor vehicle deaths, as well as the number of the population into consideration when analysing these numbers. For instance, the USA and France have the same percentage of pedestrian deaths, but it does not reflect the same situation. Indeed, in 2020, the USA revealed that 6,516 pedestrian deaths occurred for an overall motor vehicle number of deaths

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<sup>109</sup> Guichet, Bernard, “Les accidents dans les carrefours giratoires urbains: étude statistique de 1993 à 2005”, HAL Open Science, June 7 2019, p.13

<sup>110</sup> “Roundabouts”, op.cit., p.3

<sup>111</sup> Ibid., p.4

<sup>112</sup> Ibid., p.4

<sup>113</sup> Ibid., p.4

<sup>114</sup> “Roundabouts in the United States”, Summary, NCHRP report 572, 2007, p.3

<sup>115</sup> “ITS & Vulnerable Road Users”, Mobility and Transport, European Commission, p.1

<sup>116</sup> “Global Status Report on Road Safety”, WHO, 2018

<sup>117</sup> “Death on the roads Based on the Global Status Report on Road Safety 2018”, WHO, 2018

<sup>118</sup> Ibid.

of 38,824<sup>119</sup>. In 2018 in France, the number of traffic victims was 3,248 and 471 of them were pedestrians<sup>120</sup>. In 2018 in Germany, the country reported that roughly 500 pedestrians had died out of a total of 3,275 persons killed in traffic accidents<sup>121</sup>. The USA accounts for the highest number of pedestrian deaths, and France for the lowest.

A study conducted in 2009 in Europe showed a clear pattern linking the factor of age and pedestrian fatalities<sup>122</sup>. The age group from 0 to 14 years old has an overall 30% rate of pedestrian fatalities, a rather high percentage<sup>123</sup>. The lowest rate concerns the age group from 15 to 34 years old with a rate of roughly 8%<sup>124</sup>. After 34 years old, the rate continues to increase gradually and the highest rate is 54% for the age group of 85 years old and more<sup>125</sup>. This can be explained because, with age, people tend to overestimate their abilities and will cross the road at a slower speed than younger people<sup>126</sup>. With age, pedestrians will face more fatal accidents when crossing wide intersections<sup>127</sup>. The factor of age is an important characteristic to consider when analysing the deaths of pedestrians. Children and young adults are particularly vulnerable road users as they are not aware of the danger when they cross the road and take the example of adults.

It is claimed worldwide that Germans are extremely compliant with following the rules. As a matter of fact, crossing at a red light is traditionally something that is not done. Even when there are no cars on the streets, people will not cross the road, as they want to set the right example for children. It can be argued that compliance with the law is strongly rooted in German culture. According to the cross-cultural analysis of Hofstede, Germany has a high level of “avoidance of uncertainty”<sup>128</sup>. Non-Germans can characterise this behaviour as “typically German”. However, this cultural factor does not change the fact that the numbers of pedestrian deaths are similar in France and Germany.

Age plays an important role in the numbers of pedestrian traffic casualties and injuries not only in Europe but also in the USA<sup>129</sup>. This is an undeniable feature that has to be analysed as

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<sup>119</sup> “Pedestrians”, Fatality Facts, IIHS, May 2020

<sup>120</sup> “Bilan 2018 de la sécurité routière”, ONISR, September 18 2019, p.1

<sup>121</sup> “Persons killed in traffic accidents”, Statistische Bundesamt, July 7 2022, p.1

<sup>122</sup> Papadimitriou, E.; Yannis, G.; Evgenikos, P., “About Pedestrian Safety in Europe”, Road Safety and Simulation, International Conference Paris, France, October 2009, Figure 3, p.2

<sup>123</sup> Ibid., p.2

<sup>124</sup> Ibid., p.2

<sup>125</sup> Ibid., p.2

<sup>126</sup> Manze Guo, Zhenzhou Yuan, Bruce Janson, Yongwin Peng, Yang Yang and Wencheng Wang, “Older Pedestrian Traffic Crashes Severity Analysis Based on an Emerging Machine Learning XGBoost”, Sustainability, Research Gate, January 2021, p.3

<sup>127</sup> Ibid., p.4

<sup>128</sup> “What about Germany?”, Hofstede Insights, p.3

<sup>129</sup> “Older Pedestrian Traffic Crashes Severity Analysis Based on an Emerging Machine Learning XGBoost”, op.cit., p.2

the world's population is ageing. 65-year-old people and older are the most vulnerable age group category of pedestrians in the US<sup>130</sup>. The rate of pedestrian deaths increased by 3% between 1990 and 2018 in the country<sup>131</sup>. The age group of 55-59 years old and 75-79 years old have the greatest total pedestrian deaths and the numbers of deaths were respectively 281 and 271 per 100,000 people<sup>132</sup>.

The safety of pedestrians also depends on the urban area in which they walk. A study conducted in Austin Texas, showed that urban expressways, commercial districts, high parking density, high density of four-way intersections, and road sections will increase the risk for the safety of pedestrians<sup>133</sup>. On the contrary, local roads, single-family housing lots, and connecting sidewalks will provide more safety for pedestrians<sup>134</sup>.

In the context of global warming, it is important to change our habits regarding the car. In this perspective, the use of bicycles has changed over the past several years in Europe and is changing slightly in the USA<sup>135</sup>. A survey issued in 2020 by the German ministry of traffic showed that 30% of Germans regularly use their bikes to go to their workplace<sup>136</sup>. In comparison, the American League of Cyclists states that 0.5% of Americans use their bike to go to work<sup>137</sup>. In France, cycling also takes up a big part of transportation. This was especially observed during the Covid pandemic, when people wanted to avoid using public transportation. Governments of the U.S., France and Germany have acknowledged the importance of bicycles as an alternative transportation means to reduce carbon emissions<sup>138</sup>. However, differences in bicycle use are directly related to the culture of the country. This explains the 2.3% of cyclist deaths by all road user categories in the USA<sup>139</sup>. This is the smallest percentage compared to France with 4.7% and Germany with 12.3%<sup>140</sup>. Given the evidence from these different studies, more attention needs to be paid to education programs, which help pedestrians and drivers to increase their safety awareness.

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<sup>130</sup> Ibid., p.1

<sup>131</sup> Ibid., p.1

<sup>132</sup> Ibid., p.1

<sup>133</sup> “Older Pedestrian Traffic Crashes Severity Analysis Based on an Emerging Machine Learning XGBoost”, op.cit., p.4

<sup>134</sup> Ibid., p.4

<sup>135</sup> Marshall John, “Germans and their beloved bike paths”, Deutsche Welle, October 28 2021, p.1

<sup>136</sup> Ibid., p.1

<sup>137</sup> Ibid., p.1

<sup>138</sup> Ibid., p.4

<sup>139</sup> “The WHO Global Status report on road safety 2018”, the App, 2018

<sup>140</sup> Ibid.

## **Part II. Cultural Differences and Government Involvement**

### **Chapter 1 - Driving Education**

The educational program for traffic rules is the first concrete approach that future drivers have of the right behaviour to adopt on the road. Driving licence education includes a theoretical and practical test to learn all the tools needed to engage in safe driving. The system of education differs from country to country in many ways. This also concerns the driver point systems for driving licences. In this chapter, I will examine the cultural differences regarding driving education.

#### *The Driver's licence exams*

Driving tests show some similarities between the USA, Germany and France, but differ in some aspects. And so it is important to take into consideration the cultural differences in these three countries.

#### *Age Requirements*

To begin with, the three countries do not have the same age requirements for drivers. In France and Germany the minimum driving age is 18 years old. In the U.S. the age varies between 16 and 18 years old depending on the state. In each country, younger people can begin to learn how to drive before the official age. This comes with particular criteria that depend on the country's requirements. In Washington for example, 16 year olds can obtain their Intermediate Driver's Licence after possessing a valid instruction permit for six months<sup>141</sup>. The licence is issued after a trial period of six months, during which the teenager must have driven 50 hours under the supervision of their guardian and without committing any offences<sup>142</sup>. However, this comes with some restrictions, like carrying a limited number of passengers and driving only during certain hours of the day<sup>143</sup>. Turning 18, the teenager will not have to engage in further administration papers to obtain their driver's licence<sup>144</sup>. In Germany, accompanied driving can start at the age of 17 and teenagers will obtain their

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<sup>141</sup> "Driving laws", Washington State Office of the Attorney General, p.1

<sup>142</sup> Ibid., p.1

<sup>143</sup> Ibid., p.1

<sup>144</sup> Ibid., p.1

driver's licence at the age of 18<sup>145</sup>. In France, teenagers can learn how to drive as young as 16 years old, but under the supervision of an experienced driver<sup>146</sup>. The teenager takes the theoretical test before taking 20 driving lessons<sup>147</sup>. After that, the teenager has to drive at least 3,000 kilometres in the country for a minimum period of one year<sup>148</sup>. For the future, there is a proposal to lower the legal driving age to 16 without an accompanying person and the minimum 20 hours of compulsory driving<sup>149</sup>. This idea is not welcomed by all and many see it as a risk of increasing accidents among young drivers<sup>150</sup>. Indeed, in the USAs teenage drivers account for a high number of road fatalities and the number is almost 3 times higher than amongst 20 year old drivers<sup>151</sup>.

### *Theoretical exam*

In all three countries, candidates obtain their driver's licence after first taking a written multiple-choice test before passing the practical driving exercises. The theoretical test has to be prepared beforehand by attending classes at driving schools or registering on eLearning platforms, such as *Ornikar* in France or *MVPProctor* in the USA for example. The test assesses the knowledge of traffic laws and regulations gained by the student during the learning period<sup>152</sup>.

The French and German tests have approximately the same number of questions but do not require the same result to pass the exam. The French driving knowledge exam has 40 multiple-choice questions and students must have no more than 5 wrong answers<sup>153</sup>. In Germany, the test has 30 questions and students can have up to 10 wrong answers and still pass the exam<sup>154</sup>. This shows that the theoretical test is more challenging and harder to obtain in France than in Germany.

This can be linked to the educational system in the two countries. According to Hofstede's cultural dimension theory, French and German cultures are considered to be individualistic,

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<sup>145</sup> "Driver training and licence acquisition in Germany", Moving International Road Safety Association, 2013, p.2

<sup>146</sup> "Driving licences: early learning (AAC) from 15 years of age", Service-public, November 05 2021, p.1

<sup>147</sup> Ibid., p.3

<sup>148</sup> Ibid., p.3

<sup>149</sup> Sdiri Noah, "l'âge légal du permis de conduire bientôt abaissé à 16 ans", Capital, April 11 2023, p.2

<sup>150</sup> Ibid., p.2

<sup>151</sup> "Fatality Facts 2020 Teenagers", IIHS, May 2022, p.1

<sup>152</sup> Butterworth William, "How long does it take to get your licence?", The Cold Wire, January 8, 2022, p.9

<sup>153</sup> "Driving license: how to pass the code (common theoretical test or ETG)?", Service Public, December 15 2022, p.2

<sup>154</sup> "Driving licence in Germany for foreigners", expatrio, 2023, p.2

however not to the same degree, and this shows considerable cultural differences<sup>155</sup>. France has a high degree of individualism, that promotes an elitist competitive educational system<sup>156</sup>. This can be compared to the USA, as it is also known to be highly competitive, and where “people should strive to be the best they can be”<sup>157</sup>. The winner and loser angle is anchored in the country’s culture and it is assumed that a certain degree of conflict will push people to try the best they can to succeed<sup>158</sup>. This is explicitly shown by the selective and competitive environment provided by the Ivy Leagues in the USA. On the other hand, Germany does not promote competition in education. On the contrary, the emphasis is put on learning in groups as a collective mindset<sup>159</sup>.

Another important cultural difference can be observed between Germany and the USA. Germany is a federalist country and the *Länder*, the federal states, have their own constitutions<sup>160</sup>. The *Länder* each have different legislations regarding some functional aspects of the country, and the school systems are shaped by each one of the state’s institutions for example<sup>161</sup>. However, the driving licence test is the same for all *Länder*.

The USA is also a federal government and the 50 States have their own laws and regulation systems<sup>162</sup>. But unlike in Germany, the states in the USA have different test criteria and requirements to obtain a driver’s licence.

To illustrate my analysis, I will look at the Washington system, which is considered to be the most demanding, and compare it to the state of Florida, which appears to be less stringent<sup>163</sup>. In Washington, the written knowledge test has 40 questions and the students have to answer correctly at least 32 of them so they can pass the exam<sup>164</sup>. In Florida, the test has 50 questions, and for some of them the students will have 50 seconds to answer them correctly and they will only be allowed 10 wrong answers to pass the test<sup>165</sup>. In France, the candidate learns all about first aid learning for this exam, in Germany however, candidates have to take a first aid course<sup>166</sup>.

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<sup>155</sup> “Country Comparison”, Hofstede Insights, p.1

<sup>156</sup> “Les différences culturelles entre l’Allemagne et la France au quotidien et au travail”, connexion emploi, p.6

<sup>157</sup> “Country Comparison, What about the USA?”, Hofstede Insights, p.4

<sup>158</sup> Ibid., p.4

<sup>159</sup> “Les différences culturelles entre l’Allemagne et la France au quotidien et au travail”, op.cit., p.6

<sup>160</sup> “A comparative analysis of the governments of the United States of America and Germany and their historical development”, Pre-University Paper, Grin, 2017, p.4

<sup>161</sup> “Germany’s school system”, The Federal Government, p.1

<sup>162</sup> “The differences between Federal, State, and Local Laws”, Legal Aid Society of Northeastern New York, Law Help, p.2

<sup>163</sup> “Driver’s license in the USA”, The American Dream, Green Card Experts, p.3

<sup>164</sup> “Washington Driver’s licence & Permit FAQ, WA Permit Test: Get Ready!”, Driving test, p.1

<sup>165</sup> “Florida Driver’s Licence & Permit FAQ, Take your FL Permit Test”, Driving tests Florida, p.1

<sup>166</sup> Richardson Danielle, “How to get a German driver’s licence”, Expactica, February 22 2023, p.6

In all three countries, the theoretical tests have about the same number of questions but the differences in passing the exam are more noticeable according to the country's culture.

Driving a car requires good visual acuity<sup>167</sup>. The visual requirements for drivers in the three countries are 0.5<sup>168</sup>. This is why candidates for a driver's licence in the USA and Germany have to pass a visual acuity test before they can be considered fit to drive<sup>169</sup>. Again, these tests have different criteria depending on the states. In Washington for example, the visual test also includes a colour recognition test<sup>170</sup>. On the contrary, France does not require candidates to pass a visual acuity test, but it must be indicated on the driver's licence if the driver needs glasses to drive<sup>171</sup>.

### *Practical test*

After obtaining favourable results, students will have to take driving lessons and they will be evaluated during the day of the exam on different criteria. These criteria may vary from country to country and in the case of the USA, from state to state. Overall, the DMV recommends between 45 and 75 hours of driving lessons, with 45 lessons conducted with a driving instructor<sup>172</sup>. In France for example, students must take at least 20 hours of driving lessons before being able to register for the practical exam<sup>173</sup>. In comparison, German students will have to practise a few hours around the driving school before taking at least 12 mandatory hours of practice on different roads and also at night before passing the practical test<sup>174</sup>. The number of required driving lessons seems to be less in Germany than in France and the USA. In Germany, people without a licence can learn on closed training circuits to practise outside of driving hours<sup>175</sup>. The infrastructure reproduces the main traffic routes and people can gain confidence in traffic circles, intersections and parking techniques<sup>176</sup>. The person who trains must be accompanied by a licenced driver and is not allowed to drive faster

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<sup>167</sup> Owsly Cynthia, McGwin Jr. Gerald, "Vision and driving", Vision Research, Volume 50, Issue 23, Science Direct, November 23 2010, p.1

<sup>168</sup> "Driving eyesight rules - Do I need glasses to drive?", rhinocarhire, p.2,3

<sup>169</sup> "Vision and driving", op.cit., p.4 / "Driving and Vision", European Council of Optometry and Optics, Position Paper, November 2010, p.1

<sup>170</sup> "Washington Driver's licence & permit FAQ, Apply for your WA license", Driving test, p.1

<sup>171</sup> "Visual standards for driving in Europe", ECOO, "Profile of licence renewal visual requirements across European countries", Table 3, January 2017, p.8

<sup>172</sup> "How many driving lessons do I actually need", July 22 2019, Northwest Driving and Traffic School, p.1

<sup>173</sup> "Combien d'heures de conduite faut-il en moyenne pour décrocher son permis", ornikar, p.2

<sup>174</sup> "Driving licence in Germany for foreigners", Expatrio, p.5

<sup>175</sup> ADAC Road safety practice circuit, ADAC, p.1

<sup>176</sup> Ibid., p.1

than 30 km/h<sup>177</sup>. This allows people to learn in their spare time and it can perhaps explain why the number of driving hours required is less than in France and the USA. In general, during the practical exam, the examiner will look at the student's ability to drive safely in different traffic areas.

The driving test fees differ between the European countries of France and Germany and the states in the USA. In some countries, the high fees can create a social barrier to obtaining a driver's licence. This is a concerning issue because a driver's licence is often seen as a means for personal and professional empowerment<sup>178</sup>. Overall, the final price varies from state to state and depends on the number of driving hours. In the USA the cost of driving lessons is set by each state and is much cheaper than in France and Germany. In the USA, the theory and driving program costs from \$200 to \$800 with the driving schools<sup>179</sup>. In Washington, the overall price for a driver's licence is \$765<sup>180</sup>. The final price depends on the number of driving hours required by each state. In France, the total cost of both exams can go from €1,200 to €1,800 depending on the number of hours the student needs in order to gain all the competencies. In my analysis, Germany is the country with the highest overall fee for a driving licence and the price range goes from €1,300 to €2,000<sup>181</sup>.

In this part, we have seen the cultural differences in the learning process to obtain a driver's licence in the USA, France and Germany. Once on the road, the countries have different licence systems that enable administrations to enforce penalties for traffic offences.

### *Licence point systems*

The USA, France and Germany have a driver point system to promote driving safety. The licence system is a way for administrations to enforce fines and penalties on drivers that do not comply with the law. However, the number of points deducted for traffic violations depends on the jurisdiction of the country. In the USA, every state has its own point system jurisdiction, but it is the system of the state of the licence holder that applies, even if the person drives outside that state<sup>182</sup>. The USA and Germany have the same point system that gives a certain number of points for traffic violations. In the USA, drivers can own up to 12

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<sup>177</sup> Ibid., p.2

<sup>178</sup> Hussain Qais, " 'The cost is terrifying': Why some young people are putting off learning to drive", *The Guardian*, May 22 2021, p.1

<sup>179</sup> Grupa Tom, "Driving school prices", Lessons, October 19 2022, p.1

<sup>180</sup> Lau Alissa, "Drivers inequity: The cost of getting behind the wheel", Nordicnews, p.1

<sup>181</sup> "Driving licence in Germany for foreigners", op.cit., p.7

<sup>182</sup> "Driver point system", Department of Motor vehicles, DC Gov, p.1



points on their licence before they lose their driving privileges<sup>183</sup>. In Germany, 8 points are enough to take the licence from the driver<sup>184</sup>. In France however, points are taken from the driver's licence originally out of 12 given points<sup>185</sup>. In all three countries, young drivers must first complete a fairly strict trial period. In the USA, young and novice drivers are not allowed to have alcohol in their blood while driving<sup>186</sup>. In Germany, the *Probezeit* last two years and during that time novice drivers will not be allowed to commit any traffic violations<sup>187</sup>. Drivers under the age of 21 will not be allowed to drink any alcohol and any violations of these rules will make the trial period start again<sup>188</sup>.

In France, the trial period is two years long, if the driver has followed the accompanied driver's program, otherwise, it is three years for the regular educational program<sup>189</sup>. During the trial period, drivers are given 6 points on their licence and are not allowed to drive at the same speed as experienced drivers on the motorway and when it rains for example<sup>190</sup>. They are also not allowed to have more than 0,2 grams per litre of blood when driving<sup>191</sup>. The novice driver will gain two to three additional points per year if they did not commit any traffic violations<sup>192</sup>. The trial period is a means to counter the high factor of risk for traffic accidents linked to a lack of experience and young age<sup>193</sup>.

Countries have to pay attention to elderly drivers, as they pose a similar issue to that of novice drivers<sup>194</sup>. This is because age affects the ability to safely manoeuvre a vehicle<sup>195</sup>. Ageing comes with health issues and can lead to a decrease in health factors that are needed to drive a vehicle<sup>196</sup>. This can lead to an overall decrease in strength, motor reflexes, and hearing loss for example<sup>197</sup>. All of these health conditions can become an issue not only for the driver himself but for all of the road users<sup>198</sup>.

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<sup>183</sup> "Driver Point System Chart", Department of Motor Vehicles, DC Gov, p.1

<sup>184</sup> "German driving laws - fines for speeding, drunk driving, parking violations etc.", *Mobilitätsmagazin*, February 5 2023, p.2

<sup>185</sup> "Driving licence: scale of points withdrawn by offense", Service-Public, January 26 2022, p.2

<sup>186</sup> "Global Status Report on road safety 2018", op.cit., p.259

<sup>187</sup> "Driver training and licence acquisition in Germany", op.cit., p.5

<sup>188</sup> Ibid., p.5

<sup>189</sup> "Réglementation pour les jeunes conducteurs", Sécurité Routière, p.1

<sup>190</sup> Ibid., p.1

<sup>191</sup> p.147

<sup>192</sup> Réglementation pour les jeunes conducteurs, op.cit., p.1

<sup>193</sup> Réglementation pour les jeunes conducteurs, op.cit., p.1

<sup>194</sup> Kleinhubbert Guido, "Unrestricted Seniors Endanger German Roads", *Spiegel International*, March 23 2012, p.4

<sup>195</sup> Segal Robert, White Monika, Robinson Lawrence, "Age and Driving", HelpGuide, p.1

<sup>196</sup> Ibid., p.1

<sup>197</sup> Ibid., p.1

<sup>198</sup> Ibid., p.1

I will examine how the USA, France and Germany supervise elderly drivers. Some countries in the European Union require elderly drivers, aged 70 to 75 and more, to have a medical examination to ensure that they can still drive safely<sup>199</sup>. In France, the driver's licence is valid all the time without any medical examination required for elderly drivers. This has been a matter of debate in the French parliament, but the idea is always rejected in the end<sup>200</sup>. Evidence shows that the elderly are at a much higher risk of serious injury or death if involved in a car accident, but they are not causing more traffic accidents than other drivers<sup>201</sup>. Germany also does not require medical examination passing a certain age for drivers<sup>202</sup>. The German ministry of transportation is willing to make a compromise and suggest a voluntary check-up for the elderly<sup>203</sup>. Hannelore Hoffmann-Born, a member of the German association of traffic medicine, sees this as a measure that is not effective enough and explains that politicians are afraid of losing votes amongst the elderly if they undermine their driving freedom<sup>204</sup>.

In order not to stigmatise the elderly, the accident investigator Brockmann recommends carrying out tests for all drivers<sup>205</sup>. In the USA, some states impose restrictions on elderly drivers and they can be subject to vision screening, road and knowledge tests, and medical examinations<sup>206</sup>. In the State of Washington D.C, 70-year-old drivers have to renew their licence in person at a DMV office<sup>207</sup>. The driver will have to take a vision test, undergo a medical examination and their driving skills will be reexamined. The DMV office will also look at the mental and physical condition of the driver, as well as their driving record to see if the driver can safely operate a vehicle<sup>208</sup>. Based on the results, the driver will not be permitted to drive during rush hours or on the motorway for example<sup>209</sup>.

In this chapter, we have looked at driver education systems in the USA, France and Germany. The analysis shows variations regarding the complexity of obtaining a driving licence. It also highlighted differences regarding the regulation and supervision of younger and elderly drivers. It is therefore important to take a closer look at the significance of age in relation to complying with traffic laws.

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<sup>199</sup> "Older drivers and french driving licences", French News, French-Property, p.1

<sup>200</sup> Ibid., p.1

<sup>201</sup> Ibid., p.1

<sup>202</sup> "Unrestricted Seniors Endanger German Roads", op.cit., p.1

<sup>203</sup> Ibid., p.7

<sup>204</sup> Ibid., p.7

<sup>205</sup> Ibid., p.7

<sup>206</sup> "Older drivers", IIHS, July 2022, p.6

<sup>207</sup> "Senior Drivers in Washington DC", DMV, March 7 2019, p.1

<sup>208</sup> Ibid., p.2

<sup>209</sup> Ibid., p.3

## Chapter 2 - Driving Behaviour

According to the WHO, factors that threaten road safety are mainly drunk driving, the non-use of a seatbelt or motorcycle helmets, speeding and driver distraction<sup>210</sup>. In this chapter, I will focus my analysis on driving behaviour depending on the age of drivers. My analysis will mainly focus on two categories: young drivers from 15 to 21 years old, and older drivers from 65 years old and more.

### *The factor of age*

Driving is a cognitively demanding task that requires attention, memory, problem-solving, and information processing skills that often decline with age<sup>211</sup>. It is also an excessive mental strain that requires multitasking and may prove to be complicated for inexperienced drivers<sup>212</sup>. The importance of analysing young and older driving behaviours is particularly relevant as the two groups are known to be at high risk for accidents<sup>213</sup>. The numbers are significantly high in all three countries. In the USA, drivers from 65 to 74 years old represent 8.1% of all fatal accidents<sup>214</sup>. In France, the number of traffic casualties decreased between 2010 and 2021 by 39% for drivers between 18 and 24 years old but increased by 22% for drivers between 65 and 74 years old<sup>215</sup>. In 2019 in Germany, older drivers accounted for 34% of all road casualties<sup>216</sup>.

The particularly high number of fatalities amongst older drivers can be explained by the rapid demographic changes in the world's population. This is why it is particularly important to look at the driving behaviours of older drivers. In 2050, the population aged 60+ years old

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<sup>210</sup> J. Parnell Katie, Stanton Neville A., Plant Katherine L., "What's the law got to do with it? Legislation regarding in-vehicle technology use and its impact on driver distraction", Volume 100, *Accident analysis & prevention*, March 2017, p.1

<sup>211</sup> Porter Bryan E., *Handbook of Traffic Psychology*, Academic Press, 2011, Freund Barbara, Smith Paula, "Chapter 24 - Older Drivers", p.339-351

<sup>212</sup> "The driver behaviour questionnaire: A French Study on Young Drivers", op.cit., p.9

<sup>213</sup> M. Porter Michelle, J. Whitton Michael, "Assessment of Driving with the global positioning system and video technology in young, middle-aged, and older drivers", *The Journals of Gerontology: Series A*, Volume 57, issue 9, Oxford Academic, September 1 2002, p.582

<sup>214</sup> "Age of driver", *Injury Facts*, National Safety Council, p.1

<sup>215</sup> "2021 Road Safety Annual Report", ONISR, Sécurité routière, September 12 2022, p.2

<sup>216</sup> Schoeters Annelies, De Vos Nathan, Sloopmans Freya, "National Road Safety Profile Germany", European Road Safety Observatory, September 13 2021, p.8

will represent 22% of the world's population<sup>217</sup>. Let's have a closer look at the share of elderly people in the USA, France and Germany. In 2030, 65+ year old Americans will account for 21% of the country's population<sup>218</sup>. Germany has one of the highest share of the population over 65 years old in Europe<sup>219</sup>. The number of people aged 67+ is expected to grow and reach 20 million by the middle of 2030<sup>220</sup>. In France, the share of 65+ years old in the country's population is expected to grow and reach 25% by 2030, and up to nearly 30% by 2050<sup>221</sup>. Overall, the share of the elderly in the three countries is going to grow exponentially. A faster ageing population can be observed in France and in Germany. This supports the importance of examining the driving behaviour of older drivers. In fact, older drivers face cognitive, physical and social challenges<sup>222</sup>. Their reduced driving ability raises a concern<sup>223</sup>. They may find themselves in driving situations in which they are unable to react safely for themselves and other users<sup>224</sup>. Cognitive impairment and dementia are becoming increasingly common among apparently healthy older adults, affecting up to a third of people over the age of 65<sup>225</sup>. An even more alarming estimate suggests that dementia is overlooked in 25% to 90% of cases<sup>226</sup>. Many older drivers voluntarily limit or stop driving, but many continue to drive<sup>227</sup>. This is especially true for people with cognitive impairments who may not have the insight necessary to recognise their limitations and adjust their driving activities<sup>228</sup>. This highlights the importance of assessing the driving skills of older drivers. Road traffic accidents are the leading cause of injury among young people<sup>229</sup>. In France, young drivers represent 21% of deaths on the road<sup>230</sup>. France has the highest rate of young drivers fatalities compared to Germany and the USA. They represent a smaller share in Germany and account for almost 12% of all road deaths<sup>231</sup>. In the USA, young drivers

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<sup>217</sup> "Ageing and health", World Health Organisation, October 1 2022, p.1

<sup>218</sup> Vespa Jonathan, "The U.S. joins other countries with large ageing population", United States Census Bureau, March 13 2018, p.3

<sup>219</sup> "Share of population over the age of 65 in European countries 2021", Statistic Research Department, February 28 2023, p.1

<sup>220</sup> "4 million more people aged 67 or over will live in Germany in 2035", Press release, Statistisches Bundesamt, December 2 2022, p.1

<sup>221</sup> Béland Daniel, Viriot Durandal Jean-Philippe, "Aging in France: Population Trends, Policy Issues, and Research Institutions", *The Gerontologist*, Volume 53, Issue 2, April 2013, p.2

<sup>222</sup> *Handbook of traffic psychology*, Freund Barbara, Smith Paula, Chapter 24 Older drivers, op.cit., p. 339-351

<sup>223</sup> Ibid., p.339-351

<sup>224</sup> Ibid., p.339-351

<sup>225</sup> Ibid., p.339-351

<sup>226</sup> Ibid., p.339-351

<sup>227</sup> Ibid., p.339-351

<sup>228</sup> Ibid., p.339-351

<sup>229</sup> Bryan E. Porter, *Handbook of traffic psychology*, Huang Patty, Koplin Winston Flaura, "Chapter 23 - Young drivers", Academic Press, 2011, p.315-338

<sup>230</sup> "The driver behaviour questionnaire: A French Study on Young Drivers", op.cit., p.1

<sup>231</sup> "Accident Statistics for young drivers in Germany", Dekra road safety, May 2022, p.1

represent 8% of all road fatalities<sup>232</sup>. Novice drivers acquire basic driving skills during their learning and supervised driving period. Research has shown that biological and cognitive factors specific to the developmental stage of adolescence influence safe driving behaviour<sup>233</sup>. Research conducted by McCartt in 2003 analysed the driving behaviour of 911 students from five northeastern states in the U.S<sup>234</sup>. The research gathered information on driving frequency and traffic violations and involvement of the young drivers in accidents<sup>235</sup>. Similar research has been conducted in other countries such as Canada and Sweden for example and they all came to the same conclusion: the crash involvement of novice drivers is high after licensure and decreases later on<sup>236</sup>. This is directly linked to the driving experience of young drivers<sup>237</sup>. In France, young drivers are twice more likely to be involved in road crashes than experienced drivers<sup>238</sup>. One crash for every 12 drivers was observed during the first 250 miles<sup>239</sup>. It was found that the crash involvement rate decreased after the first 1,000 miles had been driven<sup>240</sup>. During the first month of the study, crash involvement was perceived as highest and males and females drivers experienced almost one crash per 4,000 miles<sup>241</sup>. The crash involvement rate decreased after five months and was 1 per every 20,000 miles<sup>242</sup>. The results of this study indicate a direct correlation between the lack of experience and the crash rate of novice drivers<sup>243</sup>. A 2002 research conducted by Porter and Whitton, using GPS technology, analysed the behaviour of 24 young, adult and older drivers without the presence of an observer in the car<sup>244</sup>. The GPS technology made it possible to gather information on drivers and to analyse how they would normally drive unsupervised. The results showed differences in driving behaviours amongst the three categories of age<sup>245</sup>. The reasons however are not the same<sup>246</sup>. Young drivers are known to take more risks and have also less experience than other drivers<sup>247</sup>. Older drivers have more difficulty in assessing and judging the right

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<sup>232</sup> “Young drivers”, NHTSA, p.1

<sup>233</sup> *Handbook of traffic psychology*, Huang Patty, Koplín Winston Flaura, “Chapter 23 Young drivers”, op.cit., p.315-338

<sup>234</sup> Shinar David, *Traffic Safety and Human Behavior*; op.cit., p.266

<sup>235</sup> Ibid., p.266

<sup>236</sup> Ibid., p.266

<sup>237</sup> Ibid., p.266

<sup>238</sup> “The driver behaviour questionnaire: A French Study on Young Drivers”, op.cit., p.1

<sup>239</sup> Ibid., p.267

<sup>240</sup> Ibid., p.267

<sup>241</sup> Ibid., p.266

<sup>242</sup> Ibid., p.266

<sup>243</sup> Ibid., p.267

<sup>244</sup> “Assessment of Driving with the global positioning system and video technology in young, middle-aged, and older drivers”, op.cit., p.581

<sup>245</sup> Ibid., p.580

<sup>246</sup> Ibid., p.582

<sup>247</sup> Ibid., p.582

behaviour when driving<sup>248</sup>. It was found that young drivers “drove faster, decelerated and accelerated more abruptly, were less likely to signal before turning”<sup>249</sup>. The analysis showed that young drivers engaged in more traffic infractions than the other two groups<sup>250</sup>. The main infraction for all three groups was speeding<sup>251</sup>. But the group that engaged the more in speed infractions remained the young drivers<sup>252</sup>. Older drivers engaged more frequently than the other two groups in inattention and turning errors<sup>253</sup>. Turning errors include failure to use blinkers to signal turning, inappropriate speed and movement, and failure to safely cross and yield at an intersection<sup>254</sup>.

The French Driver Behaviour Questionnaire, DBQ, supports that factors explaining deviating driving behaviours are different concerning the age of the driver<sup>255</sup>. Inattention errors were reported most by older drivers but were also partly reported by young drivers<sup>256</sup>. In fact, driving is a complex set of subtasks that require different kinds of cognitive processes<sup>257</sup>.

Young drivers engage in a lot of risk taking behaviours when they drive<sup>258</sup>. Novice drivers are not allowed to drink and drive. But if they do, the risk of being involved in an accident increases considerably compared to older drivers<sup>259</sup>. In the USA, alcohol-impaired driving decreased among high school students between 2015 and 2017<sup>260</sup>. However, driving after the use of drugs such as marijuana alone, or combined with the use of alcohol, increased and reached 13% in 2017<sup>261</sup>. Surveys have shown that drug use while driving is potentially greater than alcohol use among young drivers<sup>262</sup>. In Germany, 25 of the 1,000 crashes involved alcohol use at the wheel among drivers aged 18-20, 25<sup>263</sup>. The highest rate was observed for the group aged 21-24<sup>264</sup>. A survey issued in 2022 in Germany clearly showed that 80% of Germans are willing to completely ban the use of alcohol before driving<sup>265</sup>. In France, 25% of

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<sup>248</sup> Ibid., p.582

<sup>249</sup> Shinar David, *Traffic Safety and Human Behavior*, op.cit., p.258

<sup>250</sup> “Assessment of Driving with the global positioning system and video technology in young, middle-aged, and older drivers”, op.cit., p.581

<sup>251</sup> Ibid., p.581

<sup>252</sup> Ibid., p.581

<sup>253</sup> Ibid., p.581

<sup>254</sup> Ibid., p.581

<sup>255</sup> “The driver behaviour questionnaire: A French Study on Young Drivers”, op.cit., p.8

<sup>256</sup> Ibid., p.8

<sup>257</sup> Ibid., p.9

<sup>258</sup> Shinar David, *Traffic Safety and Human Behavior*, op.cit., p.268

<sup>259</sup> “Fatality Facts 2020 Teenagers”, IIHS, May 2022, p.13

<sup>260</sup> “Young drivers”, op.cit., p.3

<sup>261</sup> Ibid., p.3

<sup>262</sup> Ibid., p.3

<sup>263</sup> “Accident Statistics for young drivers in Germany”, op.cit., p.5

<sup>264</sup> Ibid., p.5

<sup>265</sup> “80% of Germans support a total ban on drinking before driving”, European Transport Safety Council, July 5 2022, p.1

young drivers perceive that driving becomes dangerous only after drinking four glasses of alcohol<sup>266</sup>. This shows that French drivers have a different perception of drunk driving than Germans. More than 20% of French drivers reported driving probably over the legal limit of alcohol use in over a range of 30 days in 2018<sup>267</sup>. This is one of the highest rates among European countries<sup>268</sup>. On the contrary, 9% of German drivers reported that they were probably over the legal limit of alcohol<sup>269</sup>. The German rate is five points below the European average<sup>270</sup>. This shows a clear cultural difference between France and Germany regarding drink and driving.

Younger drivers are also more likely to text and drive and are the most involved in using their cell phones in an accident or near-accident situations<sup>271</sup>. The risk of using a cell phone while driving is high for all drivers, but the distraction is more difficult to handle for young drivers<sup>272</sup>. The distraction involving the use of cell phones while driving proved to increase the risk of crashes for young drivers<sup>273</sup>. This introduces another risk factor for road safety.

### *Distracted driving*

Distracted driving has not been given any clear definition over the years. However, a definition stated by Lee and Al. in 2008 has been used in much research<sup>274</sup>. Distraction is the “diversion of attention away from activities critical for safe driving towards a competing activity”<sup>275</sup>. Distractions leading to incidents can occur in a great number of situations. The use of technology while driving and crossing the road for example is defined as a distraction<sup>276</sup>. This is why I will focus my analysis on drivers using in-vehicle technologies as an aspect of drivers’ distraction. The reasons for distraction when driving can be different, but the result remains the same: a decrease in driving performance<sup>277</sup>. A great amount of research shows the direct correlation between mobile phone use and accidents<sup>278</sup>.

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<sup>266</sup> “The driver behaviour questionnaire: A French Study on Young Drivers”, op.cit., p.1

<sup>267</sup> “National Road Safety Profile Germany”, op.cit., p.13

<sup>268</sup> Ibid., p.13

<sup>269</sup> Ibid., p.13

<sup>270</sup> Ibid., p.13

<sup>271</sup> Shinar David, *Traffic Safety and Human Behavior*, op.cit., p.257

<sup>272</sup> “Young drivers”, op.cit., p.3

<sup>273</sup> Ibid., p.3

<sup>274</sup> “The driver behaviour questionnaire: A French Study on Young Drivers”, op.cit., p.2

<sup>275</sup> Ibid., p.2

<sup>276</sup> “Road Safety Report, France”, op.cit., p.7

<sup>277</sup> “Cell phone use while driving”, European Road Safety Observatory, 2018, p.9

<sup>278</sup> Oviedo-Trespalacios Oscar, Watson Barry, “Navigation apps are becoming a threat to road safety (beyond distraction)”, Volume 27, Issue 2, *Injury Prevention*, 2021, p.103

Distraction is not seen as a human error, but engaging in such behaviour has proven to increase the risk of road incidents<sup>279</sup>. This can be highlighted by the number of road casualties caused by distraction on the road. In the USA, a report issued by the NHTSA for 2014 reported 3,179 road casualties and 431,000 injured, as a result of distracted driving<sup>280</sup>. In 2020 in France, 13% of all road casualties happened because of distraction<sup>281</sup>. According to Roger Lewents, the German state interior minister, 1,001 accidents were reported in 2021 due to distraction<sup>282</sup>. However, German authorities do not consider distracted driving as one of the main causes of accidents and there is therefore a lack of statistics<sup>283</sup>. Distracted driving remains an important factor in road safety, as international studies have shown that it is responsible for half of road accidents<sup>284</sup>. In France and Germany, drivers are only allowed to use hand-free devices while driving<sup>285</sup>. In 14 states of the U.S., the use of a cell phone is prohibited<sup>286</sup>. 38 States however ban the use of cell phones only for novice drivers<sup>287</sup>. This is an especially important factor to analyse, as the number of in-vehicle technologies is increasing and will eventually result in more distraction for the driver leading therefore to higher risks of accidents<sup>288</sup>.

Navigation apps are used to indicate an itinerary between point A and point B. Modern technologies provide the best and faster routes for drivers. Traffic applications are also used by a lot of drivers to warn them about speed enforcement such as radar detectors and the presence of police on the roads<sup>289</sup>. This way, the driver will be informed of the speed enforcement on a certain part of the road and adapt the speed in order not to be fined for speeding. According to the German road traffic act, half of German drivers are using devices that “indicate or interfere with traffic control measures”<sup>290</sup>. In Europe for the moment, no law completely bans the use of such warning devices<sup>291</sup>. However, their use is not authorised in

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<sup>279</sup> “What’s the law got to do with it? Legislation regarding in-vehicle technology use and its impact on driver distraction”, op.cit., p.2

<sup>280</sup> “What’s the law got to do with it? Legislation regarding in-vehicle technology use and its impact on driver distraction”, op.cit., p.2

<sup>281</sup> “Road Safety Report France”, op.cit., p.7

<sup>282</sup> Reid Alex, “Germany to catch distracted drivers holding smartphones with special cameras”, Carscoops, May 21 2022, p.1

<sup>283</sup> Schumacher Elizabeth, “Germany: Police catch 3,100 drivers on their cell phones”, *Deutsche Welle*, September 20 2018, p.1

<sup>284</sup> Ibid., p.1

<sup>285</sup> “Cell phone use while driving”, op.cit., p.17

<sup>286</sup> Ibid., p.16

<sup>287</sup> Ibid., p.16

<sup>288</sup> Ibid., p.9

<sup>289</sup> “Navigation apps are becoming a threat to road safety (beyond distraction)”, op.cit., p.103

<sup>290</sup> “Radar warning apps in road traffic: ban with backdoors”, News, Institute for European Traffic Law, August 18 2022, p.1

<sup>291</sup> Ibid., p.2



France and Germany<sup>292</sup>. Drivers can find ways to resort to these devices without breaking the law. In Germany, the driver is not allowed to use these devices but the co-driver can safely use them<sup>293</sup>. The law in France is more stringent as the use and the possession of such devices is strictly forbidden and a fine of €1,500 can be charged<sup>294</sup>. However, this does not change the fact that these applications are commonly used by drivers.

The traffic application *Waze* is an excellent way of analysing the use of this type of application and the behaviour change it generates. The application gathers 140 million users<sup>295</sup>. The system gathers information via crowd-sourced GPS data and relies only on user-generated reports<sup>296</sup>. This means that users can report and confirm all sorts of problems on their route such as accidents and the presence of speed cameras or police cars<sup>297</sup>. The application delivers real-time traffic information to its users<sup>298</sup>. Some concerns have been made about the application endangering drivers as they can make reports on the application while driving, resulting in distracted driving<sup>299</sup>. *Waze* uses sound notifications that encourage drivers to use the application while driving<sup>300</sup>. The application relies entirely on the information provided by the users, so it is important to report or confirm the presence of speed cameras or police to notify other users<sup>301</sup>. The application provides information on the presence of police officers on the road and therefore on the location of checkpoints<sup>302</sup>. This reduces the risk of drivers being controlled for speeding or using their mobile phones for example<sup>303</sup>. The dissuasive effect of the roadside check is thereby rendered meaningless<sup>304</sup>. This can lead to drivers complying with the rules only on routes where the police have been notified and continue engaging in unpunished risky behaviours when the police are not in the area<sup>305</sup>. This can ultimately lead to an increase in road accidents<sup>306</sup>. The existence of these

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<sup>292</sup> Ibid., p.1,2

<sup>293</sup> Ibid., p.1

<sup>294</sup> Ibid., p.2

<sup>295</sup> Collins Barbara, “How Google’s Waze has changed from its early days as car travel is remade”, CNBC, December 1 2022, p.1

<sup>296</sup> Christensen Kevin, Mertz Christoph, Pillai Padmanabhan, Hebert Martial, Satyanarayanan Mahadev, “Towards a Distraction-free Waze”, Digital Library, February 2019, p.1

<sup>297</sup> Salem Tala, “Why some cities have had enough of waze”, U.S. News & World Report, May 7 2018, p.1

<sup>298</sup> A.K.M Mahtab Hossain, *Geographical and Fingerprinting data to create systems for indoor positioning and Indoor/Outdoor Navigation*, “Chapter 5 - Crowdsourced Indoor Mapping”, “2.4 Waze”, Academic Press, Science Direct, 2019, p.1

<sup>299</sup> “How Google’s Waze has changed from its early days as car travel is remade”, op.cit., p.2

<sup>300</sup> “Navigation apps are becoming a threat to road safety (beyond distraction)”, op.cit., p.103

<sup>301</sup> Ibid., p.103

<sup>302</sup> Ibid., p.103

<sup>303</sup> Ibid., p.103

<sup>304</sup> Ibid., p.103

<sup>305</sup> Ibid., p.103

<sup>306</sup> Ibid., p.103

applications directly undermines traffic law and its enforcement by the police<sup>307</sup>. These technologies that circumvent the traffic law system and therefore the law, reveal a deeper problem<sup>308</sup>. They show that some telecommunications and mobile technology companies are not committed to promoting safety on the roads<sup>309</sup>. There is a real need for joint efforts between different stakeholders to decrease the number of road deaths<sup>310</sup>. Some devices show the commitment of certain stakeholders, such as the “Do Not Disturb While Driving” feature offered by Apple<sup>311</sup>. This feature enables drivers to silence notifications so that the driver is not distracted while driving<sup>312</sup>. A notification for a call will only go through if the phone is connected to a hand-free device for example<sup>313</sup>. Text messages can therefore be read by Siri and will enable the driver to keep the focus on the road<sup>314</sup>. Governments have acknowledged the danger of mobile use while driving and have implemented rules<sup>315</sup>. However, the problem of navigation apps has not been addressed properly<sup>316</sup>. It is now important that governments recognise the danger of these technologies and directly require the companies that use them to take steps to discourage drivers from using their cell phones<sup>317</sup>. Prevention professionals must continue to study the road user’s behaviour and engage with the industry to minimise negative consequences.<sup>318</sup>

There is a need to advocate with governments for more effective regulation and to be responsive to new technologies. Overall, joint efforts of governments and institutions are highly needed to improve safety on the roads.

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<sup>307</sup> Ibid., p.103

<sup>308</sup> Ibid., p.103

<sup>309</sup> Ibid., p.103

<sup>310</sup> Ibid., p.103

<sup>311</sup> Abesamis Demarest Abigail, “How to use Driving Focus on your iPhone to eliminate distractions in the car”, Business Insider, May 25 2022, p.2

<sup>312</sup> Ibid., p.2

<sup>313</sup> Ibid., p.2

<sup>314</sup> Ibid., p.2

<sup>315</sup> Tabor Thomas, “Distracted Driving: How in-car Media use may affect driving ability”, Cache Digital Archive, 2014, p.1

<sup>316</sup> Ibid, p.1

<sup>317</sup> “Navigation apps are becoming a threat to road safety (beyond distraction)”, op.cit., p.103

<sup>318</sup> Ibid., p.103

### Chapter 3 - Road Safety Improvement

The European Commission views road safety at the same level of production as any other good and service<sup>319</sup>. The production process is seen as a three-tier system of management: the institutional management functions produce interventions, which then produce results. Governments and institutions have a key role to play in making roads safer<sup>320</sup>. The beginning of the motorisation phenomenon in the 1950s and 1960s led to many deaths and encouraged governments to implement rules<sup>321</sup>. They began to establish rules to follow and penalties for the drivers that would not comply with them<sup>322</sup>. Everything was put in place to change the driving behaviour of car users<sup>323</sup>. Over the last three decades, the number of road deaths in OECD countries has been drastically reduced as a result of road safety interventions<sup>324</sup>.

How are the American, German and French governments and national institutions managing road safety? The European Commission wants to drastically reduce road traffic deaths by 2050<sup>325</sup>. To do so, they plan to gradually reduce the casualties and expect to reduce by half the numbers by 2030<sup>326</sup>. The U.S. Department of Transportation, DOT, has the same goal and wants to bring in the long-term a “zero roadway fatalities” result<sup>327</sup>. Progression has already been made but numbers have begun to rise again since 2020 and efforts to bring them down have to increase<sup>328</sup>. Institutional and governmental interventions are going to achieve the long-term objective of reducing road deaths and injuries<sup>329</sup>. High-income countries like the USA, France and Germany already benefit from collaborative institutions that put together their knowledge for safer roads. This is the case of the United Nations Economic Commission for Europe, UNECE, the IRTAD and The World Forum for Harmonization of Vehicle Regulations for example<sup>330</sup>. A step further has to be taken to enhance safety technologies.

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<sup>319</sup> “The road safety management system”, Mobility & Transport - Road Safety, European Commission, p.1

<sup>320</sup> Bliss Tony, Breen Jeanne, “Meeting the management challenges of the decade of Action for Road Safety”, IATSS Research, December 24 2011, p.5

<sup>321</sup> Ibid., p.6

<sup>322</sup> Ibid., p.7

<sup>323</sup> Ibid., p.7

<sup>324</sup> “Towards Zero: Ambitious road safety targets and the safe system approach”, OECD, International Transport Forum, 2008, p.107

<sup>325</sup> Ibid., p.7

<sup>326</sup> Ibid., p.7

<sup>327</sup> “Implementing the National Roadway Safety Strategy”, U.S. Department of Transportation, p.1

<sup>328</sup> Ibid., p.2

<sup>329</sup> “Towards Zero: Ambitious road safety targets and the safe system approach”, op.cit., p.186

<sup>330</sup> Ibid., p.187

## *Safety technologies*

Remarkable achievement towards safer vehicles has been made over the last decade<sup>331</sup>. The safety improvements were made to minimise injuries from a crash, as it was the case with three-point seat belts, airbags and shatter-resistant glass for example<sup>332</sup>. Today, safety improvements are directly targeting the cause of crashes, as they minimise human error<sup>333</sup>. In 2008, many safety features were developed in OECD countries<sup>334</sup>. Amongst the intelligent vehicle features are driver assistance systems, collision avoidance systems and collision notification systems<sup>335</sup>. The Advanced Driver Assistance Systems, ADAS, is a means to significantly reduce the number of road crashes due to human errors<sup>336</sup>. The features include “pedestrian detection/avoidance, lane departure warning/correction, traffic sign recognition, automatic emergency braking, and blind spot detection”<sup>337</sup>. The features help the driver to maintain speed and stay between the lanes when cornering<sup>338</sup>. The lane departure warnings help the driver to get back in the lane if they deviate from it<sup>339</sup>. The emergency brake assist system automatically detects vehicles that are too close and makes the car decelerate or brake sharply to avoid a crash<sup>340</sup>. Cameras can also detect obstacles on the road and inform the driver<sup>341</sup>. Many car manufacturers offer safety features bundled with other non-safety-related items, making the additional cost too high<sup>342</sup>. Safety features should be standard<sup>343</sup>. “Our vision is to design cars that should not crash and by 2020 no one will be killed or injured in a Volvo”, this was the vision statement of the car company Volvo in the 2000s and it is hoped that this kind of corporate value will push competitiveness to another level to improve safety on the road<sup>344</sup>.

In the USA and Europe, there has been a call to address the problem of driving under the influence of alcohol. The device is called “ignition interlock”, and can be used as an alternative to withdrawing the driving licence<sup>345</sup>. The device is said to be 40% to 95% more

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<sup>331</sup> “Towards Zero: Ambitious road safety targets and the safe system approach”, op.cit., p.122

<sup>332</sup> “What is ADAS?”, Synopsys, p.3

<sup>333</sup> Ibid., p.1

<sup>334</sup> “Towards Zero: Ambitious road safety targets and the safe system approach”, op.cit., p.122

<sup>335</sup> Ibid., p.123

<sup>336</sup> “What is ADAS”?, Synopsys, p.1

<sup>337</sup> Ibid., p.1

<sup>338</sup> Vickers Aaron, “Saving Lives with road safety technologies”, Ferrovial, July 20 2020, p.4

<sup>339</sup> Ibid., p.4

<sup>340</sup> Ibid., p.4

<sup>341</sup> Ibid., p.4

<sup>342</sup> “Towards Zero: Ambitious road safety targets and the safe system approach”, op.cit., p.122

<sup>343</sup> Ibid., p.122

<sup>344</sup> Ibid., p.122

<sup>345</sup> “Alcohol interlocks”, Mobility & Transport - Road Safety, European Commission, p.2

effective than the licence withdrawal to prevent drunk driving recidivism<sup>346</sup>. The device is a breath test that will prevent the car from starting if the driver does not meet the legal limit of alcohol consumption<sup>347</sup>. The device will at the same time enable gathering data on driving behaviour<sup>348</sup>. Some European countries, amongst them France, have decided to introduce this device in their legal driving system<sup>349</sup>. Since 2019, this device can be offered as an alternative to withdrawing the licence of the driver<sup>350</sup>. However, this technology comes at 100€ per month or 1,300€ if purchased and must be paid for by the driver<sup>351</sup>. In 2011, the German Federal Highway Research Institute set up pilot projects to test the effectiveness of the system<sup>352</sup>. The project was finalised in 2013 and has not seen any implementation of the device in the country<sup>353</sup>. In the USA, 280,000 interlock devices were installed in 2013<sup>354</sup>. The country accounts for the highest number compared to the countries of the European Union<sup>355</sup>. Over half of the U.S. jurisdictions request interlock devices in the vehicle of certain drink-driving offenders<sup>356</sup>. This will help reduce the number of fatalities linked to alcohol-impaired driving by 9,400 per year in the USA<sup>357</sup>.

Another technology enhances the safety of vulnerable users when crossing the road. The countdown traffic light enables drivers to see how long they have to wait for the green light and how much time they have left to cross the intersection safely<sup>358</sup>. This works also for pedestrians and cyclists who can know how much time they have to cross the street<sup>359</sup>. In the USA, the automotive constructor Audi has introduced the traffic light countdown inside the car on the dashboard<sup>360</sup>. This technology is not common in France, as only the French cities of Neuilly-sur-Seine and Strasbourg are using it<sup>361</sup>. However, countdown traffic lights are used a lot in Germany<sup>362</sup>. They were first implemented in 2005 in Hambourg, the second

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<sup>346</sup> Ibid., p.2

<sup>347</sup> “Alcohol interlocks in Europe”, ETSC, 2020, p.5

<sup>348</sup> Ibid., p.5

<sup>349</sup> Ibid., p.5

<sup>350</sup> Ibid., p.11

<sup>351</sup> Ibid., p.11

<sup>352</sup> Martino Angelo, Sitran Alessio, Rosa Caterina, “Technical development and deployment of alcohol interlocks in road safety policy”, Directorate General for internal policies, European Parliament, 2014, p.38

<sup>353</sup> Ibid., p.38

<sup>354</sup> Ibid., p.34

<sup>355</sup> Ibid., p.34

<sup>356</sup> Ibid., p.40

<sup>357</sup> “Alcohol-detection systems could prevent more than a fourth of U.S. road fatalities”, IIHS, July 23 2020, p.2

<sup>358</sup> Barreto Victor, “Improving road safety with technology innovation”, Geotab, June 19 2018, p.3

<sup>359</sup> Ibid., p.3

<sup>360</sup> Ibid., p.4

<sup>361</sup> “Neuilly is preparing for countdown traffic lights for pedestrians”, Teller Report, November 17 2022, p.1

<sup>362</sup> Ibid., p.2

biggest city in the country<sup>363</sup>. Cameras have also been placed at the busiest intersection in Hambourg to adjust the time of the traffic lights going green for pedestrians and cyclists<sup>364</sup>. This way, pedestrians and cyclists can cross the road safely during busy traffic times<sup>365</sup>.

Another important aspect to improve safety on the road is the post-crash response. After a crash, the response for emergency has to be fast and effective to minimise the severity of injuries<sup>366</sup>. ECall is an in-vehicle system that can be activated by the driver or passenger by pushing a button or is directly activated by the sensors after the accident<sup>367</sup>. The call will provide the nearest emergency services with the exact information of the time of the crash, the type of vehicle and the exact location<sup>368</sup>. It will also connect vehicle occupants to the emergency services and the trained eCall operator<sup>369</sup>. European policy orientations are willing to expand the system to other vehicles<sup>370</sup>.

Road safety technologies are a step forward to improve road safety. The technologies have already proven that they are effective. Future technological advancement will provide even more effectiveness towards reaching the zero fatalities vision aimed by governments. The USA, France and Germany have expressed their intention to drastically reduce their road deaths and injuries<sup>371</sup>. In order to achieve their long-term goal of zero roadway fatalities, the three countries need to harmonise their interventions and share their results for further progress<sup>372</sup>.

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<sup>363</sup> Schlabbach Klaus, "Countdown Signals for pedestrians in Germany", Scribd, 2010, p.1

<sup>364</sup> "Road Safety Strategy: 3 major transportation innovations", Michelin, March 12 2022, p.4

<sup>365</sup> Ibid., p.4

<sup>366</sup> "Advanced driver assistance systems", European Commission, 2016, p.25

<sup>367</sup> Ibid., p.25

<sup>368</sup> Ibid., p.25

<sup>369</sup> Ibid., p.25

<sup>370</sup> Ibid., p.29

<sup>371</sup> "Towards Zero, Ambitious road safety targets and the safe system approach", op.cit., p.192

<sup>372</sup> Ibid., p.192

## **Conclusion**

The number of road casualties has been significantly reduced over the past decades. However, the problem remains a social and economic burden for countries, even for high-income countries such as the USA, France and Germany. The coronavirus pandemic has underlined cultural differences in driving behaviours. Drivers in all three countries have engaged in quite similar driving behaviours, but my research has enabled me to establish concrete cultural differences between the three countries.

Another important discovery was the difference in infrastructure, and particularly in relation to one of the points of my research dissertation: the case of roundabouts. The analysis of roundabouts has clearly shown that the choice of infrastructure is closely linked to culture and has a great impact on the safety of road users. Compared to traditional traffic light intersections, roundabouts have proven to present fewer conflict points that increase the risk of accidents. Even if the design of such infrastructure has raised some concerns regarding the safety of vulnerable users, it remains safer than traditional intersections.

Vulnerable users are an important category to consider when analysing safety on the road. Cultural differences in choices of mode of transport lead to different outcomes concerning the safety of vulnerable users. The factor of age plays an important part of the analysis of pedestrians' safety. Children and young adults are particularly endangered when crossing the street. However, differences in education as to whether to cross at a red light impact the outcome. This led us to analyse the education program to obtain a driver's licence. This is the first concrete approach to traffic rules and the right driving behaviour to adopt. This makes it a key resource to shape and supervise drivers' behaviour. Cultural differences were found in the complexity to pass the theoretical driving test. The French test was found to be the most difficult, and the German one leaves the most room for error. This highlights the difference in the educational systems of the two countries.

Once again, the factor of age is really important. The lack of experience of novice drivers and the decrease in driving abilities for older drivers has proven to increase the risk of crashes. After they acquire a certain amount of driving experience, young drivers tend to engage in a lot of risk taking driving behaviour more frequently than adult drivers. The example of distracted driving involving the use of a cell phone while driving is a good example of that. The use of in-vehicle technology is also considered to emphasise distracted driving. The warning traffic application *Waze* based on user-generated reports increases this behaviour.

The application indicates speed enforcement areas and the presence of the police, diminishing the whole enforcement system. However, a clear ban or regulations on such applications has not been implemented. This is why joint efforts of governments and institutions are needed to regulate technologies and improve safety on the road. This is particularly important as institutional and government involvement, as well as the implementation of different safety technologies, are aiming at the “Zero Vision” traffic casualties. Many evidence-based interventions aim at reducing the number of road fatalities and injuries. It concerns law enforcement, safe road design, improving vehicle safety standards, and effective post-crash management.

Modern technologies are being further pushed to reduce human error, considered the main factor for road crashes. Road accidents pose a significant economic burden and a public health problem, as they affect people of all ages and therefore represent a high social cost to the community<sup>373</sup>. Improving safety on the road is beneficial by reducing health costs. The high socio-economic burden of road fatalities is useful to compare with other policy investments, to evaluate the level of priority given to road safety by national governments<sup>374</sup>. Comparing the burden that road fatalities represent for countries also provides a useful insight.

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<sup>373</sup> Lucidi Fabio, Girelli Laura, Chirico Andrea, Alivernini Fabio; Cozzolino Mauro, Violani Cristiano, Mallia Luca, “Personality Traits and Attitudes Toward Traffic Safety Predict Risky Behaviour Across Young, Adult and Older Drivers”, Volume 10, *Frontiers in Psychology*, March 11 2019, p.2

<sup>374</sup> Wijnen Wim, Stipdonk Henk, “Social costs of road crashes: An international analysis”, *Accident Analysis & Prevention*, Volume 94, September 2016, pages 97-106, p.2



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