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# Self-driving cars and the chilling effect of liability law

Maurice Schellekens\*

Tilburg Institute for Law, Technology, and Society, Tilburg University, Netherlands

## ABSTRACT

### Keywords:

Self-driving vehicle  
Robotics  
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Experimental self-driving cars are being tested on public roads, and will at some point be commercially sold or made otherwise available to the public. A self-driving car and its digital control systems take over control tasks previously performed by the human driver. This places high demands on this control system which has to perform the highly complex task of driving the car through traffic. When this system does not perform its task adequately and damage ensues the failure of the control system may be used as a stepping stone to claim liability of the manufacturer of the car or the control system. Uncertainties about the application of (product) liability law may slow down the uptake of self-driving cars more than is warranted on the basis of technical progress. This article examines how the decision about the timing of a market introduction can be approached and how possible chilling effects of liability law can be redressed with an adequate system of obligatory insurance.

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## 1. Introduction

Self-driving cars are in the news and experimental vehicles are hitting the road.<sup>1</sup> The Google self-driving car without steering wheel or pedals is tested on public roads in early 2015.<sup>2</sup> A company called Delphi is able to offer car manufacturers all the bespoke parts they need to turn their production vehicles into self-driving cars.<sup>3</sup> Car manufacturers

have expressed predictions of when automated cars are expected to be marketed. Most predictions speak of a moment around 2020 to 2025.<sup>4</sup> Self-driving cars relieve their human drivers from many tedious tasks and are believed to create many benefits: travelling time can be used for more worthwhile purposes than controlling the car, road safety increases, people who are physically impaired will become more mobile, traffic flow is improved and the environment suffers less.

\* Tilburg Law School, Tilburg Institute for Law, Technology, and Society (TILT), Tilburg University, PO Box 90153, 5000 LE Tilburg, Netherlands.

E-mail address: [m.h.m.schellekens@tilburguniversity.edu](mailto:m.h.m.schellekens@tilburguniversity.edu).

<sup>1</sup> Walker Smith, 2014.

<sup>2</sup> Alexis Davies, Google's Self-Driving Car Hits Roads Next Month—Without a Wheel or Pedals, Wired 12.23.14, available at <http://www.wired.com/2014/12/google-self-driving-car-prototype-2/>.

<sup>3</sup> Alexis Davies, A System That Any Automaker Can Use to Build Self-Driving Cars, Wired 11.18.14, available at <http://www.wired.com/2014/11/delphi-automated-driving-system/>.

<sup>4</sup> For an overview, see [http://www.driverless-future.com/?page\\_id=384](http://www.driverless-future.com/?page_id=384).  
<http://dx.doi.org/10.1016/j.clsr.2015.05.012>

Even though self-driving cars may have many benefits for society manufacturers may be hesitant to bring fully self-driving cars to the market. The control of a self-driving car in traffic is taken care of by the car instead of the human the driver. If an accident happens the car's manufacturer runs a larger risk of being targeted under product liability laws. How liability questions will be resolved is still uncertain. This makes manufacturers cautious. In fact, manufacturers are presently only offering very limited self-driving functionalities in their current ranges, in spite of the theoretical advantages that a self-driving car offers. Liability law may very well have a chilling effect on innovation and the speed with which it progresses. This article explores how a chilling effect could be defined and how it could be redressed.

Thereto, this article will address the following issues. The second section clarifies what a self-driving car is. In the third section, the rationales and standards of liability law are examined. The third section contains the main thrust of the article. The concept of a chilling effect of liability law is further clarified. An approach to mitigate chilling effects is being described and the role of insurance in liability law is examined. This article addresses legal questions from an EU perspective and where needed addresses national laws.

## 2. Classification and definition

In the introduction, the term 'self-driving' was used because this conveys best what is meant when context information is absent. In literature, the term 'automation' is used. Hereinafter, this article will follow this practice. In fact, there is not one definition of automation. There is rather a development path of technology that gives rise to a classification. The German BASt-project group identified three degrees of automation: partial-, high- and full automation.<sup>5</sup> Partial automation means automation that controls the longitudinal and transverse direction of the car, but the driver has to be ready to take over control instantly at any moment. High automation means that automation that controls the longitudinal and transverse direction of the car and the system knows its own limitations and can detect a situation in which it is over-stretched well in advance. The system will ask the human driver well in advance to retake control in such situations. While the car is driving robotically, the driver can take away his attention from driving the car and be otherwise engaged. Full automation is the same as high automation with the addition that the system brings the car in a safe state if the driver fails to retake control when summoned to do so. This means for example that the system is able to park the car on the hard shoulder if it foresees that it will be over-stretched and the human driver does not react. This article addresses high and full automation. Partial automation is not addressed except for these text fragments in which it is stated that it is addressed.

<sup>5</sup> Gasser et al., 2012.

### 2.1. Legal definitions

Four US states have enacted legislation that defines autonomous vehicles.<sup>6</sup> In the table below, the core elements of the definitions have been reproduced. Below the table, an analysis of the definitions is undertaken. The definitions have roughly the same structure. They describe the means of autonomous driving, the purpose of the means and the way of operating of the means. Furthermore, the definitions of Nevada, Michigan and Florida mention many examples of technologies belonging to the category of partial automation

<sup>6</sup> The State of Nevada interprets "the term "autonomous vehicle" to exclude a vehicle enabled with a safety system or driver assistance system, including, without limitation, a system to provide electronic blind spot assistance, crash avoidance, emergency braking, parking assistance, adaptive cruise control, lane-keep assistance, lane departure warnings and traffic jam and queuing assistance, unless the vehicle is also enabled with artificial intelligence and technology that allows the vehicle to carry out all the mechanical operations of driving without the active control or continuous monitoring of a natural person." Source: NAC 482A.010 "Autonomous vehicle" interpreted. Available at: <http://www.leg.state.nv.us/NAC/NAC-482A.html>. In California, an autonomous vehicle is defined as follows: "Autonomous vehicle" means any vehicle equipped with technology that has the capability of operating or driving the vehicle without the active physical control or monitoring of a natural person, whether or not the technology is engaged, excluding vehicles equipped with one or more systems that enhance safety or provide driver assistance but are not capable of driving or operating the vehicle without the active physical control or monitoring of a natural person. Source: Par 227.02 sub b. Cal. Vehicle Code, available at: [http://apps.dmv.ca.gov/about/lad/pdfs/auto\\_veh2/adopted\\_txt.pdf](http://apps.dmv.ca.gov/about/lad/pdfs/auto_veh2/adopted_txt.pdf). In Michigan, an autonomous vehicle is defined as follows: "Sec. 2b. (1) "Automated motor vehicle" means a motor vehicle on which automated technology has been installed, either by a manufacturer of automated technology or an upfitter that enables the motor vehicle to be operated without any control or monitoring by a human operator. Automated motor vehicle does not include a motor vehicle enabled with 1 or more active safety systems or operator assistance systems, including, but not limited to, a system to provide electronic blind spot assistance, crash avoidance, emergency braking, parking assistance, adaptive cruise control, lanekeeping assistance, lane departure warning, or traffic jam and queuing assistance, unless 1 or more of these technologies alone or in combination with other systems enable the vehicle on which the technology is installed to operate without any control or monitoring by an operator." Available at: <http://www.legislature.mi.gov/documents/2013-2014/publicact/htm/2013-PA-0231.htm>. In Florida, an autonomous vehicle is defined as follows: (90) AUTONOMOUS VEHICLE.—Any vehicle equipped with autonomous technology. The term "autonomous technology" means technology installed on a motor vehicle that has the capability to drive the vehicle on which the technology is installed without the active control or monitoring by a human operator. The term excludes a motor vehicle enabled with active safety systems or driver assistance systems, including, without limitation, a system to provide electronic blind spot assistance, crash avoidance, emergency braking, parking assistance, adaptive cruise control, lane keep assistance, lane departure warning, or traffic jam and queuing assistant, unless any such system alone or in combination with other systems enables the vehicle on which the technology is installed to drive without the active control or monitoring by a human operator. Available at: [http://www.leg.state.fl.us/Statutes/index.cfm?App\\_mode=Display\\_Statute&Search\\_String=&URL=0300-0399/0316/Sections/0316.003.html](http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=0300-0399/0316/Sections/0316.003.html).

	Nevada	California	Michigan	Florida
<i>Means</i>	vehicle is also enabled with artificial intelligence and technology that	vehicle equipped with technology that	a motor vehicle on which automated technology has been installed, either by a manufacturer of automated technology or an upfitter that	Any vehicle equipped with autonomous technology
<i>Purpose of the means</i>	allows the vehicle to carry out all the mechanical operations of driving	has the capability of operating or driving the vehicle	enables the motor vehicle to be operated	that has the capability to drive the vehicle on which the technology is installed
<i>Way of operating the means</i>	without the active control or continuous monitoring of a natural person	without the active physical control or monitoring of a natural person	without any control or monitoring by a human operator	without the active control or monitoring by a human operator

as being excluded from the definition. These lists have not been included in the table above.

In the description of the means the Californian definition is the most succinct. The definition of Nevada mentions artificial intelligence and is therewith rather specific. It is not completely clear what purpose it serves to mention artificial intelligence. Perhaps, it is meant to exclude a conventional car with a brick on the accelerator from the definition. The definitions of Michigan and Florida both contain the word ‘automated’ or ‘autonomous’. This makes their definitions recursive.

The description of the purpose of the means differs too between the states. The Nevada definition appears not to be completely sharp. By speaking of ‘carrying out all the mechanical operations of driving’ the element of control is not clearly expressed: the technology controls the driving behavior of the vehicle. The definition in Michigan uses the passive form (to be operated) thus leaving some doubt as to who is operating the vehicle: man or machine? Elsewhere in the definition a human operator is mentioned, hence it is probably meant that a human is operating the vehicle in the sense of using the vehicle. This use of the word ‘operating’ is a little confusing. The definitions of California and Florida are sharper in that they express that the technology drives the vehicle.

The way of operating the means also differs between the states. All definitions state that control or monitoring by a natural person in one form or another is lacking. The definition in Michigan is the strictest. It does not allow any control or monitoring by a human operator. May be this is a bit too stringent. Automated cars with high automation (as in the BAST categorization) could be excluded from this definition. The other definitions speak of active (physical) control or (continuous) monitoring. This could be interpreted as leaving room for high automation. The natural person is not actively controlling the vehicle, but can – well in advance – be summoned to take control if the vehicle foresees a situation that it may not master. All partially automated cars are excluded from the definitions. As stated above, this is underlined in that the definitions of Nevada, Michigan and Florida mention many examples of these technologies as being excluded.

Based on the analysis above, the following definition appears to be the best combination of elements:

*A vehicle enabled with technology that has the capability of operating or driving the vehicle without the active control or monitoring of a natural person.*

## 2.2. The state-of-the-art

Impressive demonstrations of automated cars driving on public roads are regularly reported in news media. This may yield the impression that the technology is near market ready. However, when probing deeper into the state-of-the-art it becomes clear that the demonstrations take place in favourable conditions (e.g. driving on a highway). The technologies available on in the market concern specific tasks only. Mostly, the condition of the surroundings in which these specific tasks are performed is relatively stable. In fact, there are still many technical challenges ahead on the road towards fully automated cars. The functioning of radars and sensors is an example. Technical problems include ‘the speed of response from the sensors, their sensitivity to low-light conditions, and their capability to identify the essential information and avoid interference’.<sup>7</sup>

Apart from the sensors the software that controls the car can be a problem as well. In general, software systems dealing with complex tasks have not an excellent track record of safety.<sup>8</sup> Even in conventional cars software can lead to accidents.<sup>9</sup> The software controlling an automated car has moreover to contend with signals from sensors that are ambiguous at times. Urmson, the Google Car Team Director, indicated that the Google cars are too a high extent dependent on detailed maps and the Google Car has difficulty dealing with circumstances not indicated on the maps.<sup>10</sup> There is still much work on the software to be done before a level of reliability and safety is reached that allows these cars to enter the road in the hands of members of the public.

<sup>7</sup> Chan, R. (2013), Development of autonomous vehicles involves ethical issues, say experts, DIGITIMES, available at: [http://www.globalpresspr.com/uploads/news/id533/Digitimes\\_Taiwan\\_Rodney%20Chan\\_Altera\\_10-16.pdf](http://www.globalpresspr.com/uploads/news/id533/Digitimes_Taiwan_Rodney%20Chan_Altera_10-16.pdf).

<sup>8</sup> Mason 2012, Chapter 5.

<sup>9</sup> See for an example of a software failure in a digital throttle leading to unintended acceleration: Baker, Ph. (2013). Software bugs found to be cause of Toyota acceleration death.

<sup>10</sup> Reid, R. (2014). Google driverless cars not that smart, says Google driverless cars chief, available at: <http://recombu.com/cars/article/google-driverless-cars-not-that-smart-says-google-driverless-cars-chief>.

### 2.3. Admissibility to the road

A possible liability for accidents with automated cars may very well be founded on the automated car's disregard for traffic rules (Marcelis, 2014). Although it is not the aim to treat this topic exhaustively here, a few remarks need to be made in order to fruitfully discuss liability issues.<sup>11</sup> The Geneva Convention on Road Traffic (hereinafter GCRT) and the later Vienna Convention on Road Traffic (hereinafter VCRT) set rules for behavior on the road. Some of those rules may be problematic for automated vehicles. Art. 8(1) VCRT requires for example that 'Every moving vehicle or combination of vehicles shall have a driver'. Art. 8(1) GCRT contains a similar (but not equal) provision. Recently, agreement has been reached about an amendment to the VCRT and GCRT.<sup>12</sup> According to this amendment, 'Vehicle systems which influence the way vehicles are driven' are allowed if they conform to the appropriate technical prescriptions in international legal instruments. Otherwise, the driver should be able to override them or switch them off. With this amendment, the issue of the required presence of a driver should be resolved for the countries affected by this amendment. This is relevant, since non-conformance could have had a bearing on liability (the automated vehicle should not have been on the road in the first place) and anyway uncertainty about the question may enhance shilling effects on the speed of introduction.

Apart from the requirements that there be a driver present the GCRT knows a number of behavioral rules. These concern for example rules about reasonableness and prudence with which a vehicle ought to be driven (art. 10), about overtaking (art. 11) and about behavior at junctions of roads (art. 12). The requirement that 'Drivers shall at all times be able to control their vehicles' (art. 8 (5)) can be mentioned too. These rules pose formidable technical challenges to automated cars and the software that controls their behavior. In view of the fact that automated cars at least for the foreseeable future will have to share the road with human driven cars, there is no doubt that the technology will have to be able to deal with the current rules and the idiosyncrasies of human drivers. The room for adaptation of the rules to automated cars will therefore be limited. Apart from occasional adaptations, the existing rules form a minimal threshold that the technology needs to overcome before introduction to the public road can be considered as a realistic option.

## 3. Liability law

This section explains the different functions of liability law and summarizes the most relevant types of liability.

### 3.1. Function and types

Liability law is about accidents. Accidents are costly. Liability law answers the question whether the costs of accidents are borne by the victim onto whom they fall or whether those

costs can be transferred to another actor, typically somebody who is in one way or another (co)responsible for the occurrence of the damage. In doing so liability law has two direct goals or functions. On the one hand, liability law tries to minimize the occurrence and the cost of accidents. This breaks up in two sub functions of liability law. It should provide an incentive for the 'responsible' person to take adequate measures to prevent the occurrence of damage.<sup>13</sup> It should provide for corrective measures when a responsible person falls short of taking adequate measures and another suffers damages as a consequence thereof. On the other hand, liability law protects the victim by providing compensation.<sup>14</sup> This is especially important if the victim cannot very well bear those costs. Examples of the latter may be situations in which the victim is a natural person and the costs are related to injury.

When applying liability law decisions have to be made: how much money, time and effort should a potentially liable actor have spent on preventive measures? How to find an equilibrium between the accessibility and the adequacy of compensation for the victim and the burden for the liable party? Broadly speaking there are two approaches. The one is a utilitarian approach. This approach may for example ask whether decisions are efficient. An example is the famous formula of judge Learned Hand for judging the adequacy of preventive measures. According to this formula preventive measures should be taken if and when they have a value less than the expected damage that would occur if the preventive measures are not taken. The expected damage can be calculated by multiplying the amount of the damage with the probability that the damage will occur. The other approach is duty based. The extent of the preventive measures or the damages to be paid is determined in accordance with legal duties.

The legal systems under consideration have several types of liability that are potentially relevant: product liability of the manufacturer and traffic liability for the holder or driver of the vehicle. Product liability is strongly harmonized.<sup>15</sup> A producer is liable for damage caused by a defect in his product. A product is defective if it does not provide the safety which a person is entitled to expect, taking all circumstances into account, including: (a) the presentation of the product; (b) the use to which it could reasonably be expected that the product would be put; (c) the time when the product was put into circulation. Liability of the holder of a vehicle differs amongst jurisdictions. In Germany for example, the so-called Halterhaftung is laid down in art. 7(1) StVG. It makes the holder of a motor vehicle liable for damages that follow from the death or injury of a person or damage to an object that occurs in the operation ('Betrieb') of the motor vehicle. Other jurisdictions are discussed hereinafter. Liability of the driver also differs amongst jurisdictions. In Germany for example, it is laid down

<sup>13</sup> Cane 2006, p. 439–458 speaks of 'general deterrence'.

<sup>14</sup> Cane 2006, p. 408–414.

<sup>15</sup> Council Directive 85/374/EEC of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products, OJ L 210, 07/08/1985, p. 29–33 (hereinafter directive on product liability).

<sup>11</sup> Walker Smith, 2014 discusses this topic in depth.

<sup>12</sup> <http://www.unece.org/fileadmin/DAM/trans/doc/2014/wp1/ECE-TRANS-WP1-145e.pdf>.

in § 18 StVG. The driver is liable under the same conditions as the holder of the vehicle. An important difference is that the driver can escape liability, if he proves that the damage is not caused by his fault. Below, more jurisdictions will be discussed.

### 3.2. Standard of liability

This article deals with the question whether liability law constitutes a disincentive for manufacturers in the sense that they do not bring certain automated technologies to the market or introduce them later out of fear for the consequences that accidents with these technologies may have in terms of liability. When discussing the standard of liability, the focus is on product liability since this directly affects the manufacturer and the production decisions he makes. Liability of the driver or the holder of the vehicle is of no direct concern to the manufacturer, although below it will be shown that it is indirectly relevant nonetheless. In the section ‘Function and Types’ above, we saw that the standard for product liability is ‘the safety a person is entitled to expect’.<sup>16</sup> It is not a subjective standard.<sup>17</sup> The directive on product liability indicates that when applying the standard all circumstances need to be taken into account, including: (a) the presentation of the product; (b) the use to which it could reasonably be expected that the product would be put; (c) the time when the product was put into circulation. However, these circumstances do not appear to be very conducive to limiting the liability of the manufacturer (and thus neither limiting any chilling effects liability law may have). When selling an automated car in the market, the marketing department of the manufacturer will praise the vehicle. So the presentation of the product will necessarily be influenced by other considerations than limiting a possible liability. The second circumstance is also not very helpful: the use to which it could reasonably be expected that the product would be put. In case law, it has been determined that the manufacturer must take into account that the user of a product will not always take all precautions.<sup>18</sup> These circumstances rather enhance a chilling effect on liability than that they take it away. Are there other circumstances that can limit the liability? The formulation of the standard makes clear that absolute safety in the sense that the product will never give rise to damage is not always demanded. The public is not always entitled to expect this. Cars are a good example. A good luxury car pulls up in about 35 m from 100 km/h. If the braking distance would be smaller probably a number of accidents could be avoided. But at present, it would be unreasonable to state that a car with the mentioned braking distance is unsafe. For products the public is accustomed with, it is easier to see what a level of safety a person may expect, even if that level falls short of absolute safety. The question is how the standard could be

filled in with respect to a product that the public is not accustomed with, such as automated cars. What safety could a person expect? Since there is no experience with automated cars an analogy with a product with which experience does exist needs to be found. An obvious candidate for such a product is a human-driven car. It functions in the same environment as an automated car, it performs the same function as an automated car and apart from control aspects, it is identical to an automated car. So how would the standard be filled in when taking the human driven car as an analogy? It is reasonable to assume that society does not want to make a rearward step in safety when admitting automated cars to the street. So loosely formulated, the public at large is entitled to expect the automated car to be as safe as a human driven car. A difficulty in applying this criterion in this loosely formulated form is that although a human driven car may be an adequate analogue for an automated car they are not the same. It may be expected that some types of accidents can be prevented with the use of automated cars. Examples are accidents caused by tiredness, or intoxication of a human driver. However, automated cars may also introduce new causes of accidents, such as accidents caused by the physical limitations of their sensors. Another problem may be that there is not one human driver that is equal to another human driver. So to whom should you compare the automated car? These problems can be overcome or at least diminished by reformulating the standard.

The standard ‘as safe as a human driven car’ could be made more precise in the following ways:

- \* The automated car should statistically be safer than human drivers, or
- \* The automated car should be safer than the best human driver.

The first formulation is less strict than the second one. It does not mean that no accident will happen that a good human driver could have avoided. It merely means that automated cars statistically cause less (in number and in severity) accidents than cars driven by humans. In practical terms, the first formulation acts as a minimum standard. It is unlikely that automated cars not meeting this standard would be acceptable to the European public. As said before, the European public is probably not willing to make a rearward step in safety.

The second formulation means that an automated car is at least as good as the best human driver. This does not mean that no accidents with automated cars happen. It only means that if an accident happens the best human driver could not have avoided it either. The practical significance of this is that once the technology for automated driving has reached this stage nobody can reasonably object to the introduction of automated cars on safety grounds.

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## 4. Liability and innovation

Liability and innovation are not isolated from each other but influence each other. On the one hand, liability law may

<sup>16</sup> See art. 6(1) Directive 85/374/EC.

<sup>17</sup> In the recitals to the directive, it is stated somewhat differently: the safety that the public at large is entitled to expect. This formulation expresses more clearly that it is an objective standard.

<sup>18</sup> Dutch Supreme Court 2 February 1973, NJ 1973, 315, nt HB.

influence the decision of manufacturers to produce certain products. If the liability risks are deemed too high, manufacturers may delay the introduction of automated cars until technology allows a higher level of safety. Liability law may also have a positive effect on the trust that the public has in certain products. The knowledge that liability is hanging as sword of Damocles over the manufacturer's head, may imbue trust in the public that the manufacturer will not economize on safety. On the other hand, in determining liability innovation may be taken into account. A producer can for example escape product liability if he shows that the state of scientific and technical knowledge at the time when he put the product into circulation was not such as to enable the existence of the defect to be discovered. In this section, the effects of liability law on innovation in automated cars will be studied, it is found that certain adverse effects are to be expected and a way of dampening these effects is proposed.

#### 4.1. *The effect of liability on innovation*

Automated cars take over some or perhaps all functions that a traditional human driver now performs when driving a car. As we saw before this can take two forms. With partially automated cars the human driver is still the driver of the car. His function changes however. From the person actually operating the controls of the car, he becomes the person supervising the control technology, ready to intervene at any moment. With highly and fully automated cars the human user becomes at least part of the time a mere passenger in the car. The car drives itself. In the latter case, the responsibility for adequate control of the car has shifted from the human user to the machine. As corollary, if it goes wrong and accidents happen caused by inadequate control of the car, it becomes unlikely that the accident be attributable to a fault of the human user. It becomes more likely that the accident is attributable to the manufacturer of the car or at least the manufacturer of the control system.<sup>19</sup> So with highly and fully automated cars, it appears that manufacturers run a higher risk of being held liable than in human driven cars. What about partially automated cars? Here, the human driver has the final responsibility, much like in traditional cars that are operated by the human driver only. Therefore, superficially, a manufacturer does not seem to run a higher risk of being held liable, but is that really so? Operating a car is not the same as supervising the automated systems of a car. Operating the controls of a car requires active involvement of the human driver. The active involvement makes it easier for humans to concentrate and keep concentrating. Supervising a system on the other hand is to a large extent passive and carries a risk that the human driver gets distracted from his task. If this proves to be true, manufacturers may have a responsibility in designing partial automation in such a way that this risk is minimized.<sup>20</sup> This responsibility – if it is not taken on adequately – may translate into a higher liability risk compared to human operated cars. In conclusion, all forms of automation may

lead to higher liability risks for manufacturers. This is particularly the case with higher and fully automated cars.

Moreover, the problems with the sensors and software mentioned above in the section about the state-of-the-art make that a possible liability of a manufacturer may be very well become a reality. Car manufacturers are well aware of this heightened liability risk.<sup>21</sup> They are also aware that accidents with automated cars will attract much attention from the press. Negative comments in the press may lead to damage to the reputation of the manufacturer. Once news reports about crashed automated cars are publicized, it is difficult for the manufacturer to defend itself and the ensuing public discussion may be governed more by emotion than by rational arguments. In literature, it is contended that these 'market forces' make product liability law superfluous.<sup>22</sup> This however only applies when regulation on safety is strong. Below in the section about 'framework conditions' we will see that certification authorities are struggling to determine the technical requirements that an automated car must meet in order for it to be road-worthy. Hence, strong administrative laws on safety are not to be expected in the short run and this leaves society to a larger extent reliant on product liability law.

A heightened liability risk (in the sense explained above) and the prospect of damage to the reputation, make manufacturers delay the introduction of automated technologies, using the extra time to make the technology that little bit more safe. One could say that such a delay is not a bad thing. The automated cars entering the road will be safer than would have been the case had they been introduced on market earlier. But could there also be something like delaying the introduction for too long? In fact, this argument can be made. To understand this, different stages in the development of the safety of automated cars need to be discerned.

The state-of the art in safety can be described by comparing it with the safety that existing human driven cars offer. A first stage is the stage at which automated cars are statistically at least as safe as human driven cars. It is not so that in this stage no accident will happen that a good human driver could have avoided. It merely means that automated cars statistically cause less (in number and in severity) accidents than cars driven by humans. A more advanced stage in safety is reached when automated cars are at least as good as the best human driver. This does obviously not mean that no accidents with automated cars will happen. But the accidents that happen would also have happened had the car been driven by a human, even if this human was the best driver that humanity has produced. If the latter stage in safety is reached manufacturers feel comfortable to introduce automated technologies to the market. In fact, in this stage nobody could reasonably object to the introduction of automated technology on safety grounds.

Rationally, it makes sense for society to introduce automated cars from the moment they reach the stage where

<sup>19</sup> Kalra et al., 2009, p. 17–35.

<sup>20</sup> Anderson et al., 2014, p. 111–134.

<sup>21</sup> The existence of a large risk of a chilling effect of liability law in Europe is not shared by everybody. See for example van der Heijden and Wees, 2001, p. 320–321.

<sup>22</sup> Polinsky and Shavell 2010.

they are statistically safer than human drivers.<sup>23</sup> The number of accidents will drop. However manufacturers will be very hesitant to bring a car to the market that only just meets this threshold. It may cause accidents that a human driver may have been able to avoid. Arguing that automated cars are statistically safer against the backdrop of a recent accident involving an automated car where a human could have avoided the accident is an uphill battle.

The standard for product liability is the safety that a person is entitled to expect. This is an open norm that needs to be filled in for automated cars. What safety could anybody (not just the user, but also other participants in the traffic) expect? As we saw above the least standard is that an automated car should meet is that it is statistically at least as safe as non-automated car. The problem with this standard is that it is rather abstract. It is also difficult to ascertain that a car meets this standard. It is only through statistics built on large scale use that this can be proven. Therefore, it cannot be excluded that in legal practice a standard will be pushed forward that is easier to apply in an individual liability case. Such a standard could be that an automated car should be at least as good as an average or good human driver. With respect to concrete accidents, the simple question asked would be: would an average or good human driver have been able to prevent this accident? The problem with such a non-statistical, human-based standard is that an automated car is different from a human being and fails in different respects than a human does. So it is very difficult to meet such a standard for makers of automated cars.<sup>24</sup> Moreover, the standard has a simple argumentative appeal. How could one defend automated cars that are ‘worse’ than good human drivers? Car manufacturers are all too conscious of such a stringent criterion becoming the standard and the implication it could have for them.

The safety a person is entitled to expect is also dependent on the presentation of the product (art. 6(1) (a) Product Liability Directive).<sup>25</sup> In the marketing of automated cars, the benefits and new uses of cars will probably be stressed. This will push up the expectation with regard to safety that the automated car offers. The justified expectations of the safety can be lowered by attaching disclaimers to the product. However, disclaimers cannot be used to arbitrarily lower safety expectation of the public. The Dutch Supreme Court decided so explicitly<sup>26</sup>: “For

<sup>23</sup> Rationality is obviously not the only perspective by which the introduction of automated cars to the road may be judged. The ethical part of this deliverable addresses these other aspects. A societal discussion about the moment and conditions for introduction is needed.

<sup>24</sup> A variant on Turing’s imitation could test whether manufacturers have reached this stage and give scientific corroboration of the finding.

<sup>25</sup> Council Directive of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products, 85/374/EEC, OJ L 210, 7.8.1985, p. 29.

<sup>26</sup> Unofficial translation of the Dutch text: ‘Voor het antwoord op de vraag of een waarschuwing kan worden beschouwd als een afdoende maatregel met het oog op bescherming tegen een bepaald gevaar, is van doorslaggevende betekenis of te verwachten valt dat deze waarschuwing zal leiden tot een handelen of nalaten waardoor dit gevaar wordt vermeden’. Source: HR 28 mei 2004, NJ 2005, 105 (Jetblast).

the answer to the question whether a warning can be considered to be an adequate measure for protection against a certain risk, it is of decisive relevance whether it can be expected that this warning will result in acts or omissions that avoid this risk” This was not decided in a case about product liability (the case concerned the liability of the manager of an airport under general Dutch tort law), but in literature this finding is thought to be applicable to product liability as well.<sup>27</sup> In other words, if it can be expected that people will ignore a disclaimer then the disclaimer does not take away the defectiveness of the product. Disclaimers that are too artificial will not work. This presents society with an anomalous situation. If automated cars are statistically safer than human driven cars, society has good reason to allow automated cars to the road. However, for fear of liability or bad press, manufacturers do not want to run the risk to introduce automated cars until they meet a higher standard, such as: no accidents happen that a good (or even the best) human driver could have prevented.<sup>28</sup> So a delay in the introduction of automated cars can be expected that is purely down to liability law and fear for negative publicity.<sup>29</sup> This we call here the chilling effect of liability law.<sup>30</sup>

One proviso needs to be made at this point. In this text we look at safety only, other conditions relevant for the moment of introduction to the market are considered ‘*ceteris paribus*’. These other conditions could very well pull the moment of introduction forward (such as competition between car manufacturers) or push the moment of introduction further into the future (e.g. motorists not feeling comfortable with automated vehicles).

#### 4.2. How to dampen chilling effects?

The foregoing raises the question how the chilling effect of liability law can be dampened without compromising the functions of liability law.

##### 4.2.1. Assumptions and framework conditions

In order to answer that question, we make a number of assumptions: 1. Automated cars will only be introduced to the market if they are statistically safer than cars driven by humans. 2. It is in the motor insurers’ interest that the number and severity of accidents is reduced. In addition, we hold on to a number of framework conditions: the two functions of liability law stay in place and liability for accidents with automated cars should not reduce the usability of these cars to certain territories within the EU. These assumptions and framework conditions are elaborated below.

4.2.1.1. *Assumption 1: automated cars are statistically safer than cars driven by humans.* Why is it reasonable to make this assumption? Above we saw that society is most probably not willing to make a rearward step in safety with the introduction

<sup>27</sup> Pape 2006.

<sup>28</sup> Schellekens, M.H.M., Report of the second stakeholder meeting in the RoboLaw project, 29 October 2013, Ludwig Maximilians University, Munich (unpublished).

<sup>29</sup> For U.S. law see Fagnant and Kockelman, 2013, p. 12.

<sup>30</sup> Calabresi and Bobbitt, 1978.

of automated cars. Manufacturers do not want to make such a step either. But what assurances can we have that the cars are not introduced on the road before they reach this level of safety? In the solution direction described below, manufacturers are not shielded from liability altogether. Might a manufacturer make a rearward step in safety then the incentive and corrective function of liability law are still in place. Hence, there is a good reason to expect that manufacturers only introduce 'safe' automated cars to the road, and that where this is not the case corrective action on the basis of liability law can be taken.

That being said, it is not immediately clear what it means that automated cars are statistically safer than cars driven by humans. A first indication that this is the case is that insurers pay out less in compensation for accidents involving automated cars per kilometer driven in such a car than for accidents with purely human driven cars. Such a financial indicator may point to both a reduced number of accidents and a reduced severity of accidents. However, it is possible that a lower total amount in compensation is the consequence of fewer but more severe accidents. It is also possible that it is the consequence of many more but less severe accidents. 'Society' may have its views on how to assess such scenarios. More severe accidents may be deemed unacceptable even if their number is very low and the total amount of damages drops. It may also be that the amount paid in compensation is not an adequate indicator of the severity of an accident. In such cases, a correction on the financial indicator needs to be made. This once again stresses the importance of public discussion about admission of automated cars to the road and the implications this has. In the end, it is inescapable that a widely accepted view is developed about the damage society is willing to accept. Aware of the limitations the 'financial' approach has, it is assumed here that a reduction in absolute and 'per kilometer' payout by insurers is a rough but usable approximation of accident frequency and severity. Perhaps public discussion about the moment of introduction will bring to light how the approach can be improved (for example requiring less severe accidents leading to permanent invalidity). It is up to society to decide which level and type of safety it deems acceptable.

*4.2.1.2. Assumption 2: insurers have an interest in accident reduction.* For reduction of the chilling effect that product liability has on manufacturers, it is relevant that insurers have an interest in reducing the number and severity of accidents. However, insurance companies may not under all circumstances be interested in a reduction of accidents. The position insurers take depends on many factors.

An important factor may be the competitiveness of the insurance market. This can be understood as follows. If the insurance market is competitive and individual insurers cannot increase the premiums they charge to their customers, they are from an economic perspective interested in reducing the number of accidents and the compensations they have to pay out. Reduction in payout is then a way to maximise profit. If however the insurance market is not competitive, insurers may be able to compensate a greater payout of compensations with higher premiums. In such a non-competitive market, a

greater volume of damages may actually be a not unattractive scenario for insurers, since it increases turnover and profit.

Another factor may be the sense of societal responsibility insurers feel. A highly developed feeling of societal responsibility may make an insurer more inclined to make decisions that are conducive to more safety on the road. Yet another factor may be the public opinion about insurers. The financial sector has since the economic crisis of 2008 come under intensified public scrutiny. This may also provide a push in the right direction. Whether these effects materialize and how big they are cannot be said without empirical research.

Below it will appear to be important that the interests of insurers are aligned with interests of 'society'. Although nothing definitive can be said here, there is no reason to be overly pessimistic in this respect. Nonetheless, it is outside the ambit of this article to precisely determine the position insurers will take and the factors that are of influence.

*4.2.1.3. Framework condition: hold on to the functions of liability law.* As stated above the functions of liability law are the incentive and corrective function and the compensation function. The provision of compensation to the victim is an important element to be included. If compensation to the victim is not guaranteed the stakes in disputes ensuing from accidents with automated cars will be very high and victims will pursue compensation with more zeal. This would only enhance chilling effects. We choose not to do away with the incentive and corrective function since it must be possible to act against manufacturers that deliver unsafe cars, even if these cars comply with all the formal standards about roadworthiness.<sup>31</sup> Another important reason to hold on these functions is that the state-of-the-art is not yet able to deliver sufficient safety for all traffic situations in which an automated car might find itself. This might not be a conclusive argument if we had rules about roadworthiness that precisely prescribe what safety an automated car must provide. Reality however is that certification authorities are at the moment far from able to specify the requirements that an automated car must meet to be roadworthy.<sup>32</sup>

*4.2.1.4. Framework condition: an EU-wide solution.* Regulation of the liability for accidents with automated cars should be EU wide because it is relevant that the users of automated cars can use their cars throughout the EU and are not limited to

<sup>31</sup> This is in accordance with statements by a representative of major car manufacturer in the second RoboLaw stakeholder meeting that it will assume complete liability when necessary. Schellekens, M.H.M., Report of the second stakeholder meeting in the RoboLaw project, 29 October 2013, Ludwig Maximilians University, Munich (unpublished).

<sup>32</sup> Department for Transport, The Pathway to Driverless Cars: A detailed review of regulations for automated vehicle technologies, February 2015, available at: [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/401565/pathway-driverless-cars-main.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/401565/pathway-driverless-cars-main.pdf), section 17.8 to 17.10, p.117. In this policy document, the UK government indicates that it will work with a Code of Practice instead of vehicle certification of automated cars for testing purposes. The reason for doing so is that drawing up certification rules takes too much time and is too difficult as the field is still in development.



their own country or a limited number of countries within the EU. Free movement of goods provides a baseline for bringing the approaches of different Member States into line. Individual Member States must allow vehicles that have been type-approved in another Member State. But since automated driving is a burgeoning and complex field it would be unwise to have no further regulation in place than the free movement of goods. Disputes between member States on the free movement of automated cars need to be prevented.<sup>33</sup> The traffic rules and layout of roads in the Member States differ too much. Within the context of the freedom of movement, it may be difficult to see what the practical implications are of admission of foreign-approved vehicles. A more concrete and harmonized context is needed to make cross-border use of automated cars a reality. Furthermore, the national requirements for type-approval must not be allowed to diverge too much or to be too tailored to a national situation. Hence, there are good arguments for a harmonized approach.

#### 4.2.2. *Reduction of chilling effects of product liability*

The challenge is to provide for a system in which the manufacturer is not overexposed to liability (this would lead to a chilling effect on innovation) but also not underexposed (this would undermine the functions of liability law, namely the prevention of accidents and compensation to the victim).

Insurance can provide part of the solution. It ensures that the victim is partly or wholly compensated. In most countries the driver or holder of a vehicle that takes part in traffic is under a duty to insure for liability or the costs of accidents. Hereinafter, it is examined whether and how this scheme can be applied to automated cars. Two preliminary issues require attention here. First, it is unclear whether insurers will be prepared to insure automated vehicles<sup>34</sup> Here, the two assumptions that we made above come into play. If automated cars are only introduced when they are statistically safer than present cars and if insurers have an interest in reduction of accidents, then we can be reasonably optimistic that insurers will want to insure automated cars. It is then in their interest to stimulate the manufacture and use of automated vehicles. The introduction of insurance for automated vehicles may theoretically have to contend with a chicken-and-egg-problem. With no automated cars on the road an insurer may not be able to assess whether automated cars are really safer and decide not to insure them for the foreseeable future. Without insurance no cars will appear on the road that provide the necessary statistical data. This problem is in practice much smaller than theoretically is expected. Manufacturers

<sup>33</sup> The TFEU does allow for prohibitions justified on grounds of public morality, public policy or public security, the protection of health and life of humans, animals or plants, or the protection of industrial and commercial property, as well as other mandatory requirements recognised by the Court of Justice (e.g. protection of the environment). Such prohibitions must, however, be proportionate and must not amount to arbitrary discrimination or a disguised restriction on trade between Member States.

<sup>34</sup> In Italy, traffic-insurers are obliged to accept new customers; however there are other Member States where insurers are at liberty to refuse a traffic insurance, e.g. in the Netherlands.

introduce automated features step-by-step. Lane keeping and advanced cruise control is already on the market as comfort or safety enhancing features. The gradual transition into automated driving gives insurers the chance to collect data and ensures that no plunge into uncharted waters needs to be made.

The second preliminary issue is the effect of insurance on manufacturers: will it lead to overexposure to liability if the insurer takes over the claim that the victim held or underexposure if no recourse against the manufacturer can be had? If insurers have no recourse against manufacturers the incentive and corrective function of liability are no longer effective. Hence, some recourse against manufacturers is needed,<sup>35</sup> but how to create the right incentive? Here the second assumption comes into play. If insurers are interested in a reduction of accidents, they may make judicious use of their power to take recourse against the manufacturer. It diminishes their interest in pursuing manufacturers that conscientiously build automated cars, but are struck by bad luck. They are the manufacturers of the cars that overall reduce the number of accidents. This is of course no hard guarantee. Individual insurers may still exhibit opportunistic behaviour and sue manufacturers in the prospect of a payout. The proposed solution should therefore be seen more in terms of containing the problem within bounds than as a hard guarantee against chilling actions. With a view to the incentive and corrective function of liability law it is also not desirable to remove all opportunities to take action against manufacturers that deliver sub-standard automated cars. In addition, insurance has the advantage that the insurer instead of the victim is a party in a possible legal dispute. This may take the emotion out of the case largely.

#### 4.2.3. *Type of insurance and underlying law*

The way in which liability law is given shape in a jurisdiction indicates what type of insurance is needed to cover damages caused by automated cars. There are different variants in place. Many countries have special rules about the liability of the driver of a vehicle, combined with a legal duty to take insurance coverage. Second, the holder of the license to a vehicle can be subject to liability and to a duty to insure. The conditions vary per country. Third, traffic accidents may be largely withdrawn from the field of liability and be covered by first-party insurance. This is a model adopted in Sweden.

#### 4.2.4. *Liability of the driver*

There are different systems for liability of the driver. The attribution of liability to the driver may be based on a fault of the driver or on the ground that it is in the societal setting at hand reasonable that the driver carries the burden of liability. The legislator may deem no-fault liability of the driver reasonable because driving a car introduces a risk in society or because the driver is obligatorily insured. These ways of attribution are often called fault-based and risk-based

<sup>35</sup> See Department for Transport, *The Pathway to Driverless Cars: A detailed review of regulations for automated vehicle technologies*, February 2015, available at: [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/401565/pathway-driverless-cars-main.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/401565/pathway-driverless-cars-main.pdf), section 16.6, p.110.

respectively. There are clear differences between the legal systems in Europe. In the UK, the liability of the driver is fault-based.<sup>36</sup> In Germany the fault of the driver is assumed, unless the driver proves the opposite.<sup>37,38</sup> In France, the liability of the driver is risk-based.<sup>39</sup> Both fault-based and risk-based systems could be considered for automated cars with medium to high automation. However, driver-based liability may become problematic since the role of the human driver is decreasing and in the long run the human driver may be taken out of the loop altogether. Therefore, we will concentrate here further on the two other systems: liability of the license holder and resolution outside the realm of liability law.

#### 4.2.5. Traffic insurance

This is a system used in Sweden. It is here described in very broad lines. Indemnification of the victim is the starting point of the system. The victim of a traffic accident is compensated by a ‘first party’ insurer, i.e. insurance against damage, not liability.<sup>40</sup> Persons travelling in a motor vehicle typically claim under the insurance of that motor vehicle. Persons not travelling in a motor vehicle typically claim with the insurance of the motor vehicle that is involved in the accident. Liability need not be established.<sup>41</sup> The motor vehicle insurance is obligatory. The advantages of the system are that victims are compensated more comprehensively. At the same time, some costs are saved because complicated determinations of who is liable for the accident need not be made. A traffic insurer may however try to reclaim its costs with the traffic insurer of the motorist responsible for the accident. Apart from obvious benefits, the Swedish model has some drawbacks. First, since the system is not based on liability the incentive and corrective functions of liability law are absent. This is however mitigated in that the insurance premium for accident prone vehicles (such as heavy motor cycles) may become higher which makes these vehicles less attractive. Second, the cost of insurance is borne by the victim, not by the tortfeasor. This may be perceived as unfair. However, since this cost befalls on the same group (motorists) as it would have done had there been obligatory third party insurance this drawback is of a more theoretical nature. Moreover, in Sweden, this drawback is mitigated in that Sweden has an elaborate system of social insurance that bears many of the costs associated with accidents anyway. Social insurers cannot reclaim the costs with traffic insurers.<sup>42</sup> Third, the system may be expensive, since it is easier to claim for compensation.<sup>43</sup> However, this effect - if it occurs at all - is counterbalanced by diminished legal expenses. It is not completely clear what the net effect is (more expensive or not?) or how you should value a possible higher expense: more compensation to the victim and less legal expenses are in

themselves no bad things and may even be worth a little extra cost.

What could this system mean for automated cars? A switch in other EU Member States to the Swedish model for all traffic accidents (also those involving non-automated cars) may be an option, but it has ramifications beyond the topic of this article. A more limited approach asks whether other countries could adopt the Swedish model for automated cars only. Assuming that there is a definition of what an automated car is (as discussed above) this may be possible. In Sweden, a victim of a traffic accident may still choose to hold the tortfeasor liable. Only, the route via the first-party insurer is so much easier that the liability route is hardly ever chosen.<sup>44</sup> Therefore, it might be possible to put the Swedish system on top of a liability system. This would mean that a Swedish-type of first-party insurance would be made mandatory for automated cars. A practical problem would probably be that this would make insurance for automated cars more expensive.<sup>45</sup> First, because, just like in Sweden, this insurance would attract many claims since it is an easier route for victims of accidents. Second, other countries than Sweden may have a less elaborate system of social insurance, thus leaving more costs to be covered by the traffic insurance. A higher premium may have negative effects on the success of automated cars in the market. It may also be hard to justify that automated cars attract higher insurance premiums if they are supposed to be safer than human driven cars (as per first assumption). On the plus side, it can be remarked that the loss of the incentive and corrective function with regard to the driver or user of an automated car is not so grave: the role of the driver/user is decreasing anyway with increasing automation.

#### 4.2.6. Liability of the holder of the license to the vehicle

This is a liability of the holder of the license to the vehicle. He may be liable even if he is not the driver of the car at the moment an accident occurs. This is a type of liability with a strong risk element. That does not mean that a holder cannot make relevant faults. A fault of the holder could for example be that he allows somebody to use the car who is clearly unable to drive. The holder is however also liable where he has not committed any fault. Typically, the idea behind this type of liability is that the holder has introduced a danger in society by having a car on the road. If and when this danger materializes, it is reasonable that he carries the cost of the accident. To protect the holder against claims he cannot support, there is mostly a duty to insure against the liability risk he runs.

An example is the German ‘Halterhaftung’ (liability of the vehicle-license holder). If the ‘Betrieb’ (operation) of the car causes damage, the holder of the vehicle is liable, no further conditions needing to be fulfilled to attribute liability to the holder (art. 7 StVG). The damage is covered by the insurance the holder is obliged to have in place. In the Netherlands, the owner or holder of a vehicle is liable if the vehicle is involved

<sup>36</sup> *Wing v. L.G.O.C.* [1909] 2 K.B. 652.

<sup>37</sup> § 18 Abs. 1 S. 2 StVG.

<sup>38</sup> *Gasser et al.*, 2012, p. 19.

<sup>39</sup> *Giesen* 2001, p. 136.

<sup>40</sup> *Hellner* 2001, p. 257.

<sup>41</sup> *von Bar* 2009, p. 716.

<sup>42</sup> *Hellner* 1986, p. 631.

<sup>43</sup> See for example the US experience with no-fault-insurance: RAND, What Happened to No-Fault Automobile Insurance? [http://www.rand.org/pubs/research\\_briefs/RB9505/index1.html](http://www.rand.org/pubs/research_briefs/RB9505/index1.html).

<sup>44</sup> *von Bar* 2009, p. 716.

<sup>45</sup> See for example the US experience with no-fault-insurance: RAND, What Happened to No-Fault Automobile Insurance? [http://www.rand.org/pubs/research\\_briefs/RB9505/index1.html](http://www.rand.org/pubs/research_briefs/RB9505/index1.html).

in an accident and damage is done to persons or objects other than those transported by the vehicle. There is an exception for force majeure, making this strictly speaking a form of with fault liability. But since force majeure is difficult to establish the result comes close to risk-based liability.<sup>46</sup> An important exception is that the owner or holder is not liable for damage done to free walking animals, another motor vehicle or people or objects transported by that other vehicle (art. 185.3 WvW). In essence, the Dutch liability of the holder provides strong protection for weaker participants in traffic, such as pedestrians and bicyclists. In France, liability for traffic accidents is since 1985 governed by the ‘Loi Badinter’. It established a risk-based liability for the driver or ‘gardien’ of a motor vehicle for traffic accidents (accidents de la circulation) in which the motor vehicle was involved by way of ‘implication’.<sup>47</sup>

What is the potential benefit of liability of the holder of the license to the vehicle and the duty to insure for automated cars? The advantages of this type of liability and obligatory insurance are: 1. It prevents discussion about who is driving: man or machine? So it has a strong element of technology-independence. 2. Insurance against liability is obligatory, leading to a large majority of all cars being insured. Where holders – contrary to their obligation/duty - are not insured, there are funds that compensate victims 3. This type of liability already exists in Germany and many other states and does not necessitate the introduction of something radically new.

The challenges this solution leaves open: 1. not all Member States of the EU have liability of the vehicle holder and as is apparent from what has been said above, the conditions diverge; 2. The damage to the user of the vehicle causing the accident is not covered. In the case of a ‘one sided’ accident, there may for example be nobody to hold liable. Below these challenges are elaborated upon.

**4.2.6.1. Diverging rules about liability of the vehicle holder.** If the liability of the holder in combination with the obligatory insurance is to give comprehensive protection to victims of automated cars, the divergence between EU Member States is problematic. For example, the rules in the Netherlands do not cover the situation where two cars collide. This does of course not mean that there is no liability of any person. There is a fallback on the normal rules of liability, such as the with-fault liability of the driver or product liability of the manufacturer. But these options are more cumbersome for the victim, may be difficult to apply to some automated cars (driver's liability) and may invite a chilling effect of liability law on innovation by the manufacturer (product liability). To take away uncertainties about liability risks run by manufacturers and to give equivalent protection to victims of accidents with automated cars some form of harmonization is needed.

**4.2.6.2. Insufficient coverage.** The liability of the vehicle holder may not cover all damages. For example, if the holder is driving himself and suffers damages, these are not compensated. If the victim has first-party-insurance (in addition to his insurance against liability) he may claim his

damage under that insurance. Such insurance is generally not obligatory and many drivers do not have such insurance. In the absence of insurance against damage the victim may seek direct recourse to contractual or product liability of the manufacturer of an automated car. This however may however result in a chilling effect on innovation. One option could be to leave this like it is. It is then for the holder of the vehicle to decide whether he seeks voluntary insurance cover. For the manufacturer this may be considered a residual liability risk that may not have an appreciable influence on innovation. The other option is to close the gap by requiring mandatory insurance for damage that is not covered by liability. The latter choice will bring the system closer to the Swedish model in terms of victim protection, insurance coverage and costs.

**4.2.6.3. Conclusion of this section.** A chilling effect can be dampened by giving road users adequate compensation through insurance. The manufacturer is then largely shielded from direct liability claims by road users. There are strong arguments in favor of the Swedish model of obligatory first party insurance. As a model it has important advantages. Its administration is much simpler and it is more efficient in the sense that the costs made come for a larger percentage to the benefit of victims. The challenge will be the introduction of such a system in other countries than Sweden. Especially if the system would be introduced for automated cars only, the insurance of automated cars may become very expensive. In an accident between an automated car and a human driven one, all the costs would fall on the insurance of the automated car if this car caused the accident. Nonetheless, a Swedish model for obligatory traffic insurance should be seriously considered: not just for dampening chilling effects of liability law but also for its characteristics as a system to compensate victims.

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## 5. Conclusion

Automated cars take tasks out of the hands of human drivers. This increases the exposure of manufacturers of automated cars to the risk of being held liable on the basis of product liability. It is difficult for manufacturers to quantify the risks they incur. This is an important measure due to the fact that it is unclear what accidents society is prepared to accept from automated cars. The uncertainties make manufacturers cautious to introduce automated cars to the market. This is not necessarily a good thing if it means that the introduction to the market of automated cars that are statistically safer than human driven cars is delayed in order to reach a higher level of safety. To some extent, these uncertainties can be taken away by public discussion about the safety of automated vehicles. In this article, it is contended that a chilling effect of product liability law on innovation can be further mitigated by adequate obligatory insurance. In many European countries, a system of obligatory traffic insurance is in place where the duty to insure rests on the holder of the vehicle. This system can easily be extended to automated cars. However, considerable differences exist between European countries. Differences in coverage will

<sup>46</sup> Giesen, 2001, p. 131.

<sup>47</sup> Sterk, 1994, p. 51.

lead to differential exposure of manufacturers to product liability. Some form of harmonization should therefore be contemplated. The Swedish system strongly differs from the systems in place in other countries. In Sweden, the obligatory insurance is a first-party insurance, whereas in other countries it is third party insurance. Even though the Swedish system is now the exception in Europe it should be seriously contemplated when harmonization is undertaken. It offers considerable advantages in coverage and ease of application. The chilling effect of product liability in automated driving innovations deserves attention, but is by no means an unsolvable problem. After all, automated cars are expected to be safer than human driven cars.

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