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Regulating Traffic Utopia: Liability Issues Created by Fully Autonomous Vehicles in Finnish Legislation

Bachelor Thesis

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I hereby declare that I am the sole author
of this Bachelor Thesis and it has
not been presented to any other
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Table of Contents

List of Abbreviations:

ECHR	European Charter of Human Rights
ICCPR	International Covenant on Civil and Political Rights
TIA	Traffic Insurance Act 460/2016
RTA	Road Traffic Act 267/1981
PLA	Product Liability Act 694/1990

Introduction:

The popularization of partly self-driving vehicles such as Tesla vehicles equipped with the autopilot functionality, and the likely introduction of completely autonomous vehicles in the near future, as well as their current testing, has already, and will in the future present significant legal challenges, consequently, the author chose the topic to explore how the current Finnish legal framework is capable of dealing with the liability issues involved with the introduction of autonomous vehicles in the near future.

The crux of the issue for the research arises from the soon to be obsolete assumption that the driver of a vehicle is in total control of the vehicle, and the vehicle has no capability of acting on its own, and therefore, the driver is always ultimately responsible for any damage that may occur as a result of that vehicle. Hence, a considerable paradigm shift is to be expected with the introduction of autonomous vehicles where the former "driver" becomes a passenger, completely unable to alter the course of the vehicle in any meaningful way, which presents considerable legal challenges to the current set of liability laws. Which therefore poses the problem for this research of whether or not, at the time of writing, the Finnish legal framework is capable of determining liability in incidents involving at fault autonomous vehicles.

Therefore, there are two essential research questions for this thesis. The first of which is **how well is the current Finnish liability legislation able to deal with the future introduction of autonomous vehicles, and what are the areas where the current Finnish legislation is unable to deal with the liability issues created by autonomous vehicles?** The second of which is **what are the possible solutions to the shortcomings in the current legislative framework when dealing with autonomous vehicles and what are the implications the current legislation has on the future introduction of autonomous vehicles?**

The main goal of this thesis is hence to explore the legal implications of the introduction of the fully autonomous vehicle, and as such evaluate how well the current set of Finnish legislation is able to cope with the future scenario, of a fully autonomous car being at fault for an accident that causes damage.

As to the structure of the thesis, the first section discusses the technology of an autonomous vehicle and its limitations, based upon which the likely types of categories of accidents are identified. The second chapter is an analysis of relevant current Finnish legislation, which will

then be used in the third chapter to determine how well the current legislation solves the question of liability with the different categories of accidents. The different categories of incidents will each be separately analyzed in the third section, as autonomous vehicles introduce completely new types of incidents with more complex liability questions, in addition to the more traditional accident types.

The fourth section will focus on implications of the analysis of the current Finnish legislation in the second and third sections, and offer possible solutions based upon existing foreign case and legislation. The reason foreign legal solutions and their effects, in the case of this paper in the United States that may be relevant to the liability issues created by autonomous vehicles will be examined is to identify solutions to improve Finnish legislation, guide future development and also avoid repeating the mistakes of others.

The main focus of the research will be qualitative in the evaluation of the suitability of the current Finnish legislation in determining the liability with autonomous vehicles, with the combination of various research methods such as the critical analysis of current legal acts, and policies. Moreover, there will be a brief use of exploratory legal methodology by using a case study of the effects of legislation that brought strict liability to the general aviation industry in the United States, and the insights it provides into the likely effects of introducing similar laws regarding liability issues of autonomous vehicles, and its implications for solving the liability issues created by autonomous vehicles. This is important as fully autonomous vehicles are yet to be introduced into traffic outside of limited tests, and as such there is no comprehensive legal framework designed specifically for them, and thus it is important to appreciate the likely effects revised laws introducing strict liability or similar responsibility to manufacturers of autonomous vehicles would have, and hence better understand whether or not such laws would be appropriate.

Furthermore, the research will be evaluative in the sense that it takes the current applicable legal framework and then tests if the framework can cope, in practice, with the liability questions raised by the likely scenarios of accidents that involve fully autonomous vehicles. Naturally, as there are no actual Type B vehicles outside of testing purposes in traffic, there are no actual "real-world" scenarios, and as such the current legal framework is applied to the most likely scenarios that will appear in the future, when fully autonomous vehicles have been introduced into traffic. Therefore, as it is difficult to accurately predict all the failings that fully autonomous vehicle may have in the future; there may be more imaginative and futuristic scenarios that are

not included in this paper, as the scenarios represented are only some of the more obvious candidates.

As fully autonomous vehicles are not yet introduced en masse and available for public, the effects autonomous vehicles may have on the legal system, as well as the rest of society are still highly speculative, and as the future liability issues fully autonomous vehicles will create will be heavily dependent on the direction of development taken by fully autonomous vehicles, there is a wide array of sources used in this thesis to attempt to appreciate the multitude of scenarios that may occur with autonomous vehicles, and the liability issues therein. Due to this, sources discussing ethical considerations are included as they effect the functions and features that will be developed into autonomous vehicles, as well as the implications artificial intelligence and autonomous vehicles have on criminal law, as this has the potential to overlap with the determination of liability and of course sources that are purely concerned with the liability issues of autonomous vehicles are included.

Chapter 1: Autonomous Vehicles

1.1. Levels of Automation

The likely future introduction of fully autonomous vehicles en masse to societies will have a profound effect on the way liability in traffic will be treated by the legal system, as the driver can no longer be held accountable for the actions of the vehicle. To better understand how fully autonomous vehicles will affect the way liability is construed in cases of traffic accidents, it is first crucial to understand the autonomous vehicle as a concept and the distinct variations of the autonomous vehicle.

To understand the different levels of automation, a split into five levels of distinct control as developed by the National Highway Traffic Safety Administration (NHTSA) in the United States is a useful starting point[1]. Under the NHTSA system, the levels of automation are as follows:

Level 0: No automation

Level 1: A single function is automated

Level 2: More than a single function is automated, however, not to an extent that the driver could afford be distracted, and as such the driver is still required to be vigilant over the vehicle.

Level 3: The driver can afford to be distracted, as the vehicle is capable of driving itself but may require the driver to take over at certain situations.

Level 4: complete automation, the driver is not expected to take control at all.

Currently, level 3 type of automation is widely available in the form of the Tesla fleet with their Enhanced Autopilot functionality and the "Full Self-Driving Capability", despite the latter being named to represent a Level 4 type of automation, the car models still contain the necessary devices (pedals, steering wheel) that will allow a driver to take over should the situation require, and as such do not represent a full Level 4 automation whereby the human driver has no capability of interfering[2]. As such the aforementioned Tesla system represents currently the most realistic and popular form of the autonomous vehicle and therefore, they are crucial to understanding the concept of an autonomous vehicle and how it may develop in the future.

[1] Anderson, J., Kalra, N., Stanley, K. Autonomous Vehicle Technology: A Guide for Policymakers, Santa Monica, RAND Corporation 2014 p 13

[2] Tesla, All Tesla Cars Now Being Produced Have Full Self-Driving Hardware, www.tesla.com/blog/all-tesla-cars-being-produced-now-have-full-self-driving-hardware, (20.02.2017)

The current Tesla autonomous vehicle set up relies on eight cameras, radar and ultrasonic sensors to guide its way through traffic safely, which Tesla claim will make the vehicle substantially safer than a vehicle driven by a human[3]. The benefit of using autonomous technology is that it eliminates human weaknesses such as the limitations of human vision, by for example using radar to see through fog and snow and allowing the vehicle to have complete 360-degree awareness of its surroundings to an extent not feasible for a human driver.

The desire for increased safety is a driving factor for the introduction of the autonomous vehicle, as the vast majority of current traffic accidents, up to 95 % are caused by human error[4], and as such introducing autonomous vehicle would likely result in safer travel and less fatalities, at least due to human errors.

For the purposes of this paper the categorization of autonomous vehicle will be simplified into two categories Type A vehicles and Type B vehicles. Type A vehicles represent the NHTSA levels 0-3 where the driver has not yet become a passenger, and therefore is capable actually and potentially, to alter the course of the vehicle and to override the automated control of the vehicle quickly while the vehicle is travelling. Type B will represent vehicles that have made humans in the vehicle mere passengers, in the sense that besides choosing a travel destination, they are unable to make maneuvers or override the automation of the vehicle as to its driving, that is to say, they cannot reasonably be thought to be capable of altering the vehicle behavior to for example swerve to avoid obstacles. The distinction is important, as Type A vehicles that have technologies that assist driving are closely analogous to aircraft flying with an autopilot, and should an accident happen, it would seem logical the two would be treated similarly, as in both cases the human driver or pilot has the capability of overriding the automated system, and as such current foreign case law would suggest, that if an accident happens while an aircraft is on autopilot it is not the fault of the system, but rather the pilot for failing to operate their vehicle safely[5].

[3] Tesla, Full Self-Driving Hardware on All Cars, www.tesla.com/autopilot , (20.02.2017)
[4] Beiker, S. Legal Aspects of Autonomous Driving, Santa Clara Law Review, 2012, 52(4), p 1151
[5] Marchant, G., Lindor, R. The Coming Collision Between Autonomous Vehicles and the Liability System, Santa Clara Law Review, 2012, 52(4), p 1325

1.1.1. Human intervention and Type B autonomous vehicles

As of yet there are no Type B vehicles available for the public to purchase, however as demonstrated by the type of technology in the Tesla, it is not unreasonable to consider that in the near future actual Type B vehicles will be available for the public, and will be introduced to the roads in significant numbers. However, the exact configuration and method of operation of the future Type B vehicles leaves some room for speculation, and the various possible features and configurations of Type B vehicles each create their own specific set of legal concerns.

For example, the question of whether or not an "emergency intervention" button ought to be included in Type B vehicles, that would allow the passengers occupying the vehicle to shutdown the vehicle and bring it to a halt if it begins to behave dangerous or otherwise malfunction. While it may seem like a fairly obvious solution to include such a button, it poses significant ethical and legal problems. Should such a button be present, then the vehicle occupants may be held responsible for any accident or crash the vehicle is involved in, which means that the vehicle occupants, or at least one of them, should be paying close attention to the road and the maneuvering of the car, which would largely defeat the purpose of a completely Type B vehicle, as arguably one of its main benefits is the ability to do either productive activities completely unrelated to driving such as work or even non-productive activities like sleeping whilst the system operates the vehicle, both of which would be completely negated by being held responsible for the failings of the system[6]. Furthermore, in the case of autonomous Type B vehicles, there may be a point in the future where it may be considered negligent not to use the automated system, especially if it is available, as it would represent a safer and better driver than the human alternative[7].

Moreover, the presence of an "emergency intervention" button poses additional questions such as does there need to be at least one person in the vehicle who holds an actual driver's license and thereby understands traffic to such an extent that they are able to competently intervene in traffic, which adds a concern of if such regulation of autonomous vehicles occurs, it may ruin the benefit autonomous vehicles could have provided for groups such as the disabled, the elderly or

[6] Hevelke, A., Nida-Rumelin, J. Responsibility for Crashes of Autonomous Vehicles: An Ethical Analysis, Science and Engineering Ethics, 2015, 21(3), pp 619-630
[7] Wu, S. Unmanned Vehicles and US Product Liability Law, Journal of Law, Information and Science, 2011, 21(2), p 254

the young who would not be able to drive a Type A vehicle safely or legally[8]. Furthermore, in a situation where a Type B vehicle that is used in a carpooling service, and contains an "emergency intervention" button on what could be described the "driver's position", would mean that whichever client happens to sit there at the time of an accident, could suddenly be held legally responsible for the actions of the autonomous system, as they were the person in the best position to intervene[9].

Consequently, it is not possible to state with absolute certainty that such an "emergency intervention" button would be included in future Type B vehicles, as it would stand to negate some of the benefits of the autonomous vehicle, however there is an underlying ethical concern that it is possible that autonomous vehicle would be even safer with an "emergency intervention" button used in conjunction with a capable and vigilant driver, thus further reducing fatalities if such a feature was present, meaning that potentially the legislators and or the manufacturers of the Type B vehicles would have to decide between removing some of the benefits and comfort of automation or saving lives[10].

For the purposes of this paper a Type B vehicle will be presumed not to contain any such opportunity for intervention of the persons occupying the vehicle, or alternatively that the legal system views any human intervention via such a button as coincidental, which may or may not add to safety and not as an actual duty that a "driver" can be held liable for failing to do or neglect, in order to examine the case, which may well remain hypothetical and never be realized in reality, where autonomous vehicles without a human driver cause accidents and the liability issues therein. The existence of any form of potential driver intervention would go against the purpose of this paper as it would allow for the use of the current system with minimal changes whereby the "driver" is assigned the blame for the accident in most cases, which would counteract the point of examining whether or not the current set of laws and regulations could cope with a truly driverless vehicle.

The introduction of a vehicle that is truly autonomous and cannot be influenced by the occupants to the extent that there is no "driver" inside the vehicle but merely passengers, has also raised the question that why should the owner of the vehicle have to have insurance for the vehicle as they

[8] Holder, C., Khurana, V., Harrison, F. Robotics and law: Key legal and regulatory implications of the robotics age (Part I of II), The International Journal of Technology Law and Practice, 2016, 32(3), pp 383-402
[9] Schroll, C. Splitting the bill: creating a national car insurance fund to pay for accidents in autonomous vehicles, Northwestern University Law Review, 2015, 109(3), p 815
[10] Hevelke, A., Nida-Rumelin, J. Responsibility for Crashes of Autonomous Vehicles: An Ethical Analysis, Science and Engineering Ethics, 2015, 21(3), p 624

cannot possibly influence the outcome of the traffic situations the vehicle will be involved in, and as such, the blame for any accident ought to be placed at the manufacturer[11]. However, the situation is not as simple as it may seem, as strict liability where the manufacturer is always responsible would remove any incentive from the end-user to operate the Type B vehicle safely[12], and as will be described in section 1.3 there are plenty of ways in which the end-user can cause an accident with a Type B vehicle. Moreover, section 4.1 of this paper will discuss the effects strict liability had on general aviation whereby the introduction of strict liability resulted in more fatalities and less safe aviation[13].

To summarize, for the purposes of this paper, a Type B vehicle contains no obvious features that would allow the human occupants of the vehicle to intervene in its operation and thereby absolve them of being considered the "driver" of the vehicle under the law, and as such of liability for accidents (barring a few exceptions discussed in section 1.3).

1.2. Potential issues with Type B vehicles

Before the likely types of accidents that Type B autonomous vehicles could be involved in can be appreciated, it is important to understand the limitations of autonomous vehicles and their specific vulnerabilities.

While the cameras and various sensors such as used on the aforementioned Tesla are for the most part more accurate and equally or more capable than the human sensory organs, as they can see through for example fog and heavy snow, they are not without their limitations especially in their current form. As previously mentioned there are no Type B vehicles being currently sold for the average consumer, and as such there are no previous crashes to examine, to gain a better understanding of the weaknesses of actual Type B vehicles, it is therefore necessary to examine the failings of the current technology in the most automated vehicles available of Type A, which would correspond to Level 3 of the NHTSA.

The first case of the Level 3 type of Tesla autopilot system, which is capable of driving the vehicle on highways, failing with fatal results occurred in 2016 when the car's sensor systems

[11] Bogue, R. Robot ethics and law Part two: Law,Industrial Robot: An International Journal, 2014, 41(5), p 400
[12] Cardinali, R. If the system fails, who is liable?, Logistics Information Management, 1998, 11(4), p 259
[13] Nelson, R., Drews, J. Strict product liability and safety: evidence from the general aviation market, Economic Inquiry, 2008, 46(3), p 437

failed to distinguish a white truck and trailer from the bright sky, resulting in the two vehicles colliding, with the Tesla travelling at full highway speed, resulting in the death of the driver[14]. Naturally, the accident could have been prevented if the driver had intervened in the situation as the autopilot is to be used under the responsibility of the driver, similar to that of a pilot and autopilot on an aircraft; however, it serves to highlight that even though for the most part sensors are more capable than human senses they can also be fooled and are subject to failures. As the technology progresses such failures will likely become fewer and thereby improve the safety of the systems, however, they will most likely never be completely eliminated, and as such they will likely remain a risk for any person who travels using an autonomous vehicle, especially that of Type B in the future.

However, there is an additional safety aspect to the use of automated systems without manual overrides that cannot be overlooked, which is that according to current research the reaction time for humans to take over from an automated driving system is unacceptably slow, ranging from 1.97 to 25.75 seconds with a median of 4.56 seconds when focused on driving and 3.17 to 20.99 seconds with a median of 6.06 seconds when focused on an activity other than driving[15]. To use the median values in real life traffic it would mean that at a highway speed of 80 km/h the vehicle would have travelled about 101.32 meters if focused on driving and 134.65 meters if not focused on driving. To put that into perspective the UK Department of Transport cites 53 meters as the typical stopping distance of a vehicle from 80 km/h, which includes 15 meters of thinking distance[16], therefore travelling the distance of 101.32 meters would allow a car in manual control to essentially stop twice from 80 km/h.

This is a very real concern not only for Type A vehicles that fit into Level 3 but also Type B vehicles, were they to be included with an "emergency intervention" button that would aim to bring the vehicle to a halt as quickly and safely as possible, as in this respect the autonomous vehicle is less safe than its manual counterpart. However, it would appear likely that the autonomous vehicle would overall be safer than a completely human operated car however, in the light of this research it would seem irresponsible to not take into account the safety issue of slow reaction times when taking back control from the vehicle, especially for level 3 automated

[14] Yadron D., Tynan D. Tesla driver dies in first fatal crash while using autopilot mode, The Guardian, www.theguardian.com/technology/2016/jun/30/tesla-autopilot-death-self-driving-car-elon-musk, (20.02.2016)

[15] Eriksson A., Stanton N. Takeover Time in Highly Automated Vehicles, Human Factors: Journal of the Human Factors and Ergonomics Society, prepublished 26.01.2017, DOI: 10.1177/0018720816685832

[16] Department for Transport, The Highway Code, www.gov.uk/guidance/the-highway-code/general-rules-techniques-and-advice-for-all-drivers-and-riders-103-to-158#rule126, Government of United Kingdom, (21.02.2017)

Type A vehicles. Most likely the issue will not be as present in fully automated Type B vehicles as they may not contain a possibility for any driver intervention in the real world when they are introduced.

1.2.1. Predictability and security

Furthermore, there is an added security concern regarding fully autonomous vehicles with no manual overrides, in the sense that they can be maliciously exploited by criminals due to their predictable behavior, much to the detriment of the persons occupying the autonomous vehicle, as outlined in the 2017 final report on social and behavioral questions associated with autonomous vehicles by the UCL Transport Institute.

In the report attention is raised towards the possibility of an "autonomous mugging" whereby a person stands in front of the vehicle, forcing it to stop, and then proceeding to break into the vehicle to rob the occupants[17]. To add insult to injury, the vehicle having detected the damage done to it in breaking into it, refuses to start back up owing to the damage and thus reduced roadworthiness of the vehicle, leaving its passengers stranded at the site of the robbery[17]. It is therefore the predictability of the Type B vehicles that makes them vulnerable, which conflicts with the proposed ethical value of making programming of robots, and by that extension, autonomous vehicles, as transparent and predictable as possible. On the other hand, an alternative ethical approach would be to ensure that a human maintains overall responsibility for the automated system, however, as outlined previously this might defeat the purpose of introducing Type B autonomous vehicles that would allow the human occupants to not be concerned with the operation of the vehicle as they would not be held responsible (to an extent, more about this in section 1.3)[18].

This type of scenario outlined in the UCL Transport Institute report is likely to be an archetype for the type of crimes that will be committed against Type B autonomous vehicles with no manual overrides. Arguably, it is possible to attempt a similar crime with human operated cars, however, the risk to the perpetrators is considerably higher as even though they may be successful in stopping a vehicle by standing in the middle of the road, albeit there is a risk that if its for example dark they may simply be run over and severely injured, the potential victims

[17] Cohen T., Jones P., Cavioli C. Social and behavioral questions associated with autonomous vehicles, UCL transport institute, 2017, p 66
[18] Bogue, R. Robot ethics and law Part one: Ethics, Industrial Robot: An International Journal, 2014, 41(4), p 339

would simply speed off when they realize what is about to happen, thus making the commission of such a crime riskier for the criminals of the present.

However, the possibilities of this mechanic go for beyond mere muggings as outlined in the report, as its perfectly plausible to exploit the mechanic of halting vehicles for other purposes, some of which are much more sinister such as murder, kidnapping and rape as the persons using Type B vehicles will be utterly helpless to prevent the vehicle from stopping as it will have been programmed to avoid running over humans and animals.

The risks posed by such exploitation affects both the undefined masses as well as purposefully picked targets for example, politicians, celebrities or persons otherwise targeted by public outrage. Arguably, politicians and celebrities will be better protected as they will likely have security personnel travelling with them, however, persons who may be targets due to the a variety of reasons such as journalists, dissidents and persons accused of crimes will likely not be able to afford to hire security personnel to travel with them, and are therefore disproportionately affected by such a risk.

This may have the legal implication of lawsuits against the manufacturers of the vehicles for producing them in such a fashion that they endanger, or cause the occupants to be considerably more likely to be targeted by criminals than users of regular Type A cars, and therefore have failed in the design to meet the security needs of the passengers in a foreseeable issue. Alternatively, there may be no lawsuits as there may be a "honeymoon" period for autonomous vehicles, similar to that of early air travel, where there were not many lawsuits as there was a widespread recognition of the dangers of aviation, and as such the passengers were perceived to have acknowledged and accepted the risks, thereby convincing the next of kin that there is no need to sue, and it was not until air travel became more common and widespread did lawsuits begin to emerge, as it was no longer the case that it was only a few risk takers using the aircraft, but it became a more common practice and therefore, it was no longer seen that the risks involved should be as high for the passengers[19]. This may or may not be the case for autonomous vehicle as well, that initially such occurrences of criminals exploiting the weaknesses of the fully autonomous Type B vehicles will be viewed as risks the occupants willingly accepted by purchasing an autonomous vehicle, and in the short-term there will not be as many lawsuits which will allow the technology to develop.

[19] Graham, K. Of Frightened Horses and Autonomous Vehicles: Tort Law and Its Assimilation of Innovations, Santa Clara Law Review, 2012, 52(4), p 26

However, such scenarios reframe the debate about autonomous vehicles having to make decisions over who lives and who dies, as in if the car must hit either two pensioners or a mother and child, how will the decision be made in the autonomous vehicle, in the light of the above scenario, it may also become a question of whether or not the car ought to be programmed in a way that it will in fact purposefully run over malicious actors seeking to harm the occupants of the vehicle.

If such a function is programmed, the end the result may well be a homicide in which the vehicle misinterprets a situation and ends up killing a person, on the other hand failure to do so may result in the death of one or more of the occupants, if for example the car does not run over an obviously deranged and armed person in front of the vehicle. This could mean that the programmer of the vehicle could be held responsible for homicide by the perpetrator-by-another type of model in criminal law whereby under the eyes of the law the Type B vehicle is seen as an "innocent party" who lacks the criminal state of mind and the real perpetrator is the person who orchestrated the offense, possibly the programmer who programmed the code into the system[20].

This in turn will create more potential legal issues for the manufacturers of fully autonomous Type B vehicles, consider for example a situation when a programmer in Country X programs a vehicle to comply with the local set of laws, which for the sake of argument allow the vehicle to take steps to protect the occupants by for example running over a criminal seeking to exploit the stopping mechanic of the vehicle. This type of Type B vehicle with this coding is then exported to Country Y, where the law does not allow for such actions, and the vehicles causes the death of a person in front of the vehicle, thereby potentially making both the manufacturer and the programmer liable in various legal actions. As such, it would mean that manufacturers of Type B vehicles would have to be either intimately familiar with all the legal systems of the countries their vehicles will be exported to, and potentially even non-intended export countries due to transfer between end-users, and program the vehicles accordingly, as otherwise while law abiding in one country, the vehicle may be a potential murder weapon in another. This would mean that each vehicle will have to be programmed with a different set of instructions in such scenarios for every country in the world, and then use the correct settings by detecting in which nation the vehicle is in operation, or alternatively, make sure the vehicle is programmed to never harm humans to the potential security deficit of the occupants, especially occupants in countries

[20] Hallvey, G. Unmanned Vehicles: Subordination to Criminal Law under the Modern Concept of Criminal Liability, Journal of Law, Information and Science, p 4

where violent crime may be more common and such exploitation of autonomous vehicle a more serious risk.

1.2.1.2. Cyber security and hacking concerns

The perhaps most obvious security concern in the mind of the public with fully autonomous Type B vehicles is the danger of hacking and other similar cyber security concerns. Anyone who has ever driven on narrow mountain roads will be familiar with the feeling of impending death due to a false move of the wheel, and as such, the thought of an outside influence affecting the trajectory of the vehicle at the worst possible moment will likely cause a sense of dread. A Tesla has already been hacked at the time of writing allowing the hackers to control a variety of the cars systems, including its brakes[21]. As autonomous vehicles become more popular so will, in all likelihood, hacking them become more common as well, this presents very real security concerns for the occupants of the vehicles, as for example, if hackers gain access to the directional steering or the accelerator or both, it would essentially mean the vehicle has been virtually hijacked[22]. The effects could range in anything from a speeding ticket to a fiery death, what makes the scenario more worrying is that, likely due to all of the communication systems on board the vehicle, the hacker would also most likely be able to determine where the vehicle is travelling and as such be able to plot the most destructive or deadly move for the vehicle, and as such the passenger would have no chance to realize that they have in fact been hacked, before the vehicle abruptly and violently makes for example a turn off a cliff or in front of a truck much to the detriment of the persons occupying the vehicle. Again, this type of hacking attack could be targeted towards a specific person or simply at random (more on this in section 2.2).

The car itself may not be the only vulnerable item when travelling in a Type B autonomous vehicle, as the smart transport infrastructure may additionally be the target of a cyber attack[23]. However, the vehicle will still most likely be the most vulnerable point of the equation especially as Vehicle-to-Vehicle communication will be vital to increase safety to a maximum, as it will allow the vehicle to detect threats and avoid accidents beyond the maximum range of the sensors

[21] Solon O. Team of hackers take remote control of Tesla Model S from 12 miles away,www.theguardian.com/technology/2016/sep/20/tesla-model-s-chinese-hack-remote-control-brakes, The Guardian, (21.02.2017)
[22] Douma, F., Palodichuk, S. Criminal Liability Issues Created by Autonomous Vehicles, Santa Clara Law Review, 2012, 52(4), p 1165
[23] Holder, C., Khurana, V., Harrison, F. Robotics and law: Key legal and regulatory implications of the robotics age (Part II of II), The International Journal of Technology Law and Practice, 2016, 32(4), p 573

on board the vehicle[24]. For example the current Tesla autopilot's maximum range for sensors is 250 meters[25], whereas the Vehicle-to-Vehicle currently being introduced by Mercedes-Benz ("Car-to-x") has a range that is much greater than that of the sensors on the Tesla or any car[26].

However, Vehicle-to-Vehicle communication could potentially make the vehicles more vulnerable to hacking[27], which is likely only a fraction of the ways in which autonomous vehicle become increasingly vulnerable to hacking. As the idea of a driver being able to do other activities and relax while the vehicle drives amounts to a considerable selling point for Type B vehicles, it would stand to reason that the vehicle manufactures will design their vehicles to suit the increased desire for comfort and entertainment on board.

While some of these desires can be accommodated in ways that do not affect the cyber attack vulnerability of the vehicle, such as seats and seatbelts more comfortable for relaxing and sleeping, refrigerators on vehicles for long journeys, privacy glass on all surfaces of the vehicle, there are some likely new introductions to future Type B vehicles that will serve to potentially make the vehicles more susceptible to hacking. For example, even though TV screens and DVD players and similar systems have been sold in vehicles for quite a while, it is likely that in the future there will be a demand for increased connectivity in the form of for example TV screens that are connected to a Netflix type of streaming service, that will allow the vehicle occupants to stream entertainment from the Internet. Other similar additions that may surface in the future include co-operation with video game console manufacturers for embedded systems in the vehicle with the capacity to connect to the Internet and thus enable online gaming in vehicles. All of these types of entertainment systems that connect to networks could potentially decrease the cyber security of the vehicle, and as such protecting the systems from hacking will likely become a major point of research and development for manufacturers of Type B vehicles, as the failure to provide the customers with vehicles that are safe (to the point reasonably possible), from hacking and cyber attacks will be crucial to avoid lawsuits in which Type B vehicles have been hacked and injuries or other damages to the occupants or others has occurred.

Consequently, it is likely that hacking of Type B vehicles will likely be a major security and safety threat for the occupants of the vehicles, and as such represents a threat that must be taken

[24] Wood, S., Chang, J., Healy T. The Potential Regulatory Challenges of Increasingly Autonomous Motor Vehicles, Santa Clara Law Review, p 1427
[25] Tesla, Full Self-Driving Hardware on All Cars, www.tesla.com/autopilot , (21.02.2017)
[26] Mercedes-Benz, Car-to-x Communication, www.mercedes-benz.com/en/mercedes-benz/innovation/car-to-x-communication/, (21.02.2017)
[27] Wood, S., Chang, J., Healy T. The Potential Regulatory Challenges of Increasingly Autonomous Motor Vehicles, Santa Clara Law Review, pp 1465-1466

seriously both by the manufacturers of the vehicles as well as the legislator in devising laws that would deter potential hackers from interfering with the section of the public entrusting life and limb to Type B vehicles.

1.3. Accident Categories

In order to make the analysis of the liability questions created by Type B vehicles more accurate, the likely forms of crashes Type B autonomous vehicles, with no potential vehicle occupant intervention, will be involved in must be categorized, for the purposes of this paper there will be three major groups that are further divided into sub-groups. The three major groups and subgroups will be as follows:

Group A: Hardware Failure

A1: Defect

A2: Part failure due to improper maintenance or neglect by the end-user

Group B: Software failure

B1: Defect

B2: End-user failure to maintain the system

B3: End-user modified system

Group C: External influences

C1: Weather, natural or infrastructure induced crashes

C2: Hacking

C3: Other criminal influences

1.3.1. Group A

Under Group A, the sub-group A1 is to include instances where the hardware components of the vehicle are defective without any form of neglect by the end user of the vehicle, which results in the Type B vehicle causing an accident. The word “defect” has, for the purposes of this analysis, a wide definition, which includes any shortcomings in the performance, construction or design of

a component of a Type B vehicle[28]. This category is not as futuristic as perhaps the other categories that attempt to predict the likely types of accidents involving Type B vehicles as A1 type crashes occur already with current vehicles, and as such are likely to continue happening despite automation. Examples in practice of A1 type crashes would be for example a defective axle that breaks resulting in a loss of control of the vehicle, faulty brake lines that prevent the vehicle from stopping and more specifically for autonomous vehicles, a sensor that stops working which results in the vehicle colliding with an object or person, due to either no data or false data being produced by the sensor.

Category A2 is similar to A1, however, it concerns an incident where the component that failed and caused an accident similar to A1, was not defective in the sense that when it left the manufacturer it contained faults, but rather the failure was caused by the improper maintenance of the vehicle by the end-user. This category includes some of the more ordinary failures such as failing to change the tires of the vehicle when they are dangerously worn and as a result the Type B vehicle loses control, despite the best efforts of the automated system, and causes an accident. Some of the more futuristic failures in this category may include incidents such as where the end-user of the vehicle fails to for example defrost or clear of snow camera lenses or sensors before driving the vehicle, resulting in a failure of the Type B vehicle to operate normally and thus causing an accident.

The A2 category raises the concern that was previously outlined of whether or not disabled people can operate Type B vehicles, as for examples visually impaired persons may not be able to ensure that the vehicle is roadworthy as effectively as a non-visually impaired person would, and thus may result in the vehicle being operated in a condition where it is not roadworthy. Simple practical examples of this would be that the disabled person is unable to see that snow, mud or other substances have covered sensors or that the vehicle has been damaged or that there is liquid leaking from the vehicle. Presumably, Type B vehicles would have some capacity to inform the occupants of the vehicle that there is a problem with one or more of the systems and as such would to a degree negate this issue, however, it remains to be seen how effective Type B vehicles will be at self-diagnosing their roadworthiness every time the vehicle is started up, and thus, arguably this may be a determining factor in whether or not disabled persons will be able to operate Type B vehicles safely.

[28] Wood, S., Chang, J., Healy T. The Potential Regulatory Challenges of Increasingly Autonomous Motor Vehicles, Santa Clara Law Review, 2012, 52(4), p 1479

However, the establishing of the roadworthiness of the vehicle is not an issue that affects only the potential disabled operators of Type B vehicles. It is likely that Type B vehicles will be doing "unoccupied startups" and unoccupied trips, for example, a privately owned Type B vehicle delivers its end-user to his or her place of work in the center of a city and then drives off to find a parking spot. As it is equally likely that it will be possible for the end-users of the vehicles to set up a schedule with the vehicle, for example, leaving instructions to pick up the end-user from work at four o'clock, now if the person starts working at eight o'clock that would mean that the vehicle could, for example find a parking spot an hour's drive from the city center, which does not seem that implausible considering that it is generally difficult to park cars in large cities. Therefore, hypothetically after finding a parking spot an hour away from the city center, the car starts up at three o'clock by itself and begins to drive back to the city center to pick up its end-user from work at four o'clock. Now the issue arises if the vehicle was roadworthy for the whole of the journey to find a parking spot as well as the journey back. For example, the vehicle may have driven into a pothole in the road on the way to find a parking spot, and for example developed a small leak in the brake line, and then driving back the vehicle's brakes do not function, and the vehicle crashes. In the case of a more traditional Type A vehicle, a responsible person would have presumably been able to see the puddle forming under the vehicle and connect that to incident where the vehicle hit the pothole, and thus not operate the car owing to its condition.

Therefore, the "unoccupied startups" and unoccupied journeys Type B vehicles are likely to perform, raise serious concerns regarding the potential liability issues they create, as it could be that they will allow vehicles that are not roadworthy to drive even long distance before a human can inspect the vehicle and stop it from operating. Again, the magnitude of this problem will depend on how advanced the vehicle is at self-diagnosing its roadworthiness. However, if Type B vehicles are not fully able to self-diagnose themselves before driving while unoccupied, it may be that there will be a considerable number of A2 category crashes, however, the question remains of whether or not an A2 failure can truly be blamed on the operator or end-user of the vehicle, as they would not have had the chance to inspect the vehicle before it entered traffic. Alternative solutions would include designated Type B vehicle parking lots, where a person inspects each vehicle for roadworthiness either as they are parked or as they leave, however, at peak hours of traffic when many cars are leaving this would likely not be an awfully viable option for large parking lots of Type B vehicles, though it would create employment opportunities for a society, at least until this function could also be automated.

1.3.1.2. Group B

Category B1 includes a similar concept of defect as A1 except it does not concern the physical components of the vehicle, but rather the software that operates the Type B vehicle and all other forms of software on board, that can affect the normal operation of the vehicle. Accidents in category B1 would include for example situations where the programming of the vehicle is such that it does not allow the vehicle to make the correct decision in certain circumstances, and thus result in an accident, or that it is unreasonably vulnerable to hacking. The category additionally includes software bugs that have been left in the system due to negligent testing procedures prior to the release of the software in vehicles, as well as simple design failures, such as for example a tendency for software crashes in certain circumstances. A hypothetical example might be that a vehicle developed and tested in a warm climate country functions absolutely fine in the conditions it was developed in, but then when brought to a colder country the operating software of the vehicle will be susceptible to frequent crashing in for example snowstorms resulting in accidents.

Interestingly enough, despite the fact that there are no actual Type B vehicles on the road there has been lawsuits in the United States in situations where preemptively a car manufacturer has been sued for potential crashes that would be categorized as B1 (and C2), for example in 2015, Toyota, GM and Ford where sued for providing for sale vehicles that are vulnerable to hacking in a way that would allow a hacker to gain control of essential functions of the vehicle, in this case the braking and steering, consequently it may be that B1 type crashes may result in liability lawsuits both before and after accidents happen[29].

Category B2 is similar to B1 however, in this case the resulting failure of the software that caused the crash was due to the user not, for examples updating the software as provided by the manufacturer, and as a result of not updating the vehicle crashes due to an issue that has been fixed in the software updates released by the manufacturer. Naturally there would have to be a law that would require drivers to update their vehicle's software to the latest available version[30] for the B2 category to really be implemented in the real world, as if there is no obligation or duty for the end-user to update the vehicle software, then there cannot be neglect in not doing so. However, alternatively software updates could be introduced to the mandatory vehicle

[29] Greenblatt, N. Self-driving cars and the law, IEEE Spectrum, 2016, 53(2)
[30] Wood, S., Chang, J., Healy T. The Potential Regulatory Challenges of Increasingly Autonomous Motor Vehicles, Santa Clara Law Review, 2012, 52(4), pp 1470

inspections that are required for all registered vehicles in traffic, however, in countries such as Finland it would likely be an issue that new vehicles are not required to be inspected until three years from the date of beginning of use, after which there is another gap of one year and only then do vehicle inspections become yearly[31]. While this current system is fine for Type A vehicles, as it can be reasonably presumed that a new vehicle will not develop serious issues that endanger its roadworthiness in the first 3 years of its existence, at least none that the driver would not realize to fix on his or her own initiative, the regulation would not likely transfer well to Type B vehicles, as it would be a situation analogous to not updating one's computer for the first three years, which would seem irresponsible by modern standards, and as such, if software updates were done for the end-user of the vehicle during the mandatory vehicle inspections, the regulations would have to be changed, and the interval shortened to a more reasonable time such as 6 months. However, this would present a considerable annoyance to the end-user of the vehicle as they would have to pay for the vehicle inspection every six months, and it would seem somewhat excessive considering the previous system of yearly inspection for mechanical issues. Alternatively, a completely new software inspection could be mandated for Type B vehicles, however, it would likely be counterintuitive as it would increase regulation of Type B vehicles over Type A vehicles and as such may interfere with the amount of desire potential clients have for Type B vehicles over Type A vehicles, and therefore slow down the spread of Type B vehicles in traffic. Arguably, the importance of up to date software in Type B vehicles would be similar to that of the more traditional mechanical condition of Type A vehicles, as Type B vehicles are entirely dependent on their software when they operate, and as such any software failure will likely have serious consequences, and thus the need to regulate the updating of software in Type B vehicles cannot be overlooked by legislators and national road safety administrators.

Category B3 is concerned with the end-user or operator modifying the software of the vehicle for their own purposes, likely this type of modification will include the end user installing modifications to the onboard computer systems, or in rarer cases when more technologically adept persons are involved, even programming and adding their own additional modification to the Type B vehicle's systems. These modifications may result in interference with the original software of the vehicle, and as such cause unforeseen issues that may result in an accident. As outlined above, the issue of increased regulation that Type B vehicles will likely need extends to

[31] Finnish Transport Safety Agency Trafi, Määräaikaiskatsastus, www.trafi.fi/tieliikenne/katsastus/maaraaikaiskatsastus#maaraajoin, (23.02.2017)

the end-user modifying the vehicle as well. This presents problems as even though mechanical modifications that make a vehicle not roadworthy are generally caught out by yearly inspections and police patrols in traffic, software modifications that make the software of Type B vehicles dangerous will likely be more difficult to detect, at least with the current set of inspections. For example, in the United States there is concern over the limited authority the NHTSA has of preventing aftermarket modifications to vehicles that make them potentially more dangerous to either the occupants of that vehicle or others[32]. The concern is perhaps not directly transferrable to Finnish roads, as mentioned before, there are periodic inspections in place whereas in the United States some states do not have vehicle inspections at all[33], and provided the yearly inspections would at least check that the software is as up to date as the law requires and that there are no dangerous modifications present in the vehicle at the time.

Inherently criminal modifications to Type B vehicle systems such as instructions to purposefully break the law will be discussed under section C3, the difference between B3 and C3 is that the modifications in B3 which result in an accident were not such that their primary purpose was to make the vehicle not roadworthy or to purposefully break the law, but despite that ended up in causing a collision.

1.3.1.3. Group C

Category C1 includes instances where external conditions caused the Type B vehicle to crash, and are not directly attributable to any form of software or hardware failure on part of the vehicle itself. The category is rather broad but it includes for example animal related crashes where an animal suddenly runs in front of the vehicle in a situation where it is simply not possible to avoid the collision, potential examples of this include elk running in front of the vehicle while there is oncoming traffic forcing the vehicle to crash into the elk as there is no room to avoid the impact safely. While it is likely that Type B autonomous vehicle will be able to reduce the number of collisions with animals, it is unlikely that they will be able to completely prevent them from happening owing to the sudden and unpredictable movements of animals that may result in a situation to which there is no other outcome other than a crash.

Other examples that are included in the category are for example serious road deficiencies in the road such as large potholes, extreme weather conditions such as heavy snowstorms or black ice.

[32] Wood, S., Chang, J., Healy T. The Potential Regulatory Challenges of Increasingly Autonomous Motor Vehicles, Santa Clara Law Review, 2012, 52(4), pp 1436
[33] Digest of Motor Laws, Safety Inspection, drivinglaws.aaa.com/tag/safety-inspection/ , (23.02.2017)

Category C1 does not include any purposeful manmade obstacles designed to make Type B vehicles to crash, for example should an individual lay down a spike strip to cause oncoming vehicles to crash, or other devices that are purposefully used to interfere with the operation of Type B vehicles, these types of criminal behaviors are categorized under C3.

The category of C2 concerns the hacking of the vehicles and thereby causing them to not function normally and cause an accident. As discussed previously, cyber attacks and hacking are very likely to affect Type B vehicles, and can pose a major threat to both the vehicle and its occupants. The category of C2 includes both hacking that purposefully crashes the vehicle, for example by ordering the vehicle to make a sudden left turn and thus cause a collision, as well as incidents where the purpose was not to primarily cause an accident, but for example hinder the journey of a person by making an attack comparable to a current denial of service type of attack, where the vehicle is for example spammed by vehicle-to-vehicle communications and causes the software on the vehicle to become overloaded and crash, thus hindering its operation and likely bring it to a halt. Should such a denial of service type of attack additionally result in a collision it is included in the C2 category, and it will be up to the court handling the case to decide how the attack is handled in comparison to the purposeful crashing of a car by hacking, as for the purposes of this analysis on liability, it is only relevant that the outside influence caused the vehicle to crash and not so much the actual *mens rea* behind the attack.

Needless to say, there may be cases of combined categories C2 and B1 as highlighted by the 2015 case in the United States, except likely in the future there will be actual crashes instead of potential ones, and should the attack be made possible by defective or negligently produced software in the Type B vehicle then it is very likely that the both the actual perpetrator of the attack and the manufacturer will be liable for the attack, however, how the actual courts will respond will require an analysis of actual case law involving Type B vehicles, which is not available at the time of writing.

The broadest category for criminal actions is the C3 category where there is a variety of criminal behavior that causes the systems of a Type B vehicle to malfunction, be exploited or be otherwise modified with criminal intent resulting in damage to either property or persons, this category specifically excludes hacking as it has been given a category of its own in C2. The aforementioned “automated muggings” and other possible crimes that can be committed by exploiting the potential weaknesses in the form of predictability in Type B vehicles discussed in section 1.2 are included in this category.

Chapter 2: The law of Finland and autonomous vehicles

2.1. National legislation

The Finnish legislation related to the liability and insurance of traffic accidents has recently been revised, whereby the newer Traffic Insurance Act 460/2016, as of the first of January 2017, has repealed the old Traffic Insurance Act 259/1959[34]. The new revised form of the Traffic Insurance Act has been written with the possible introduction of autonomous vehicles in mind, and as a result it enables the manufacturers of autonomous vehicles and manufacturers of a component of a vehicle to be held liable in accordance with the Finnish Product Liability Act 694/1990, in cases where the driver is not responsible for the accident, but rather the car itself or the software within[35].

To understand how well autonomous vehicles fit into the new Traffic Insurance Act 460/2016, henceforth referred to as TIA, it is necessary to understand a few key provisions and definitions. The concept of a vehicle to which the law applies to is defined in article 2 (1) of the TIA, whereby a vehicle is any motorized vehicle that is intended to travel on the ground using mechanical force, but not on rails, including towed trailers. A Type B autonomous vehicle will have no issue in fitting into this definition, as there is no mention of any requirement of driver involvement.

Next it is important to establish whether not Type B vehicles would be subject to the same duty as Type A vehicles when it comes to the mandatory traffic insurance, under article 5 of the TIA a vehicle whose "permanent home" (as defined by article 2 (9), whereby it is the state of which issued the license plate or other identifier) is Finland. Article 6 further adds that the owner or possessor of a vehicle intended for use in traffic, and not covered under the exceptions of article 8, has a duty to insure the vehicle from the day of transfer of ownership. Consequently, provided a Type B vehicle has Finnish license plates, and therefore has as its "permanent home" Finland, it will be under a duty to have insurance just like a Type A vehicle.

As to the actual compensation for traffic accidents, the third section of TIA covers the topic, with article 31 stating that traffic accidents shall be compensated for, subject to exceptions in the subsequent articles, even if nobody is personally liable for compensation on the basis of the vehicle's use in traffic. Article 32 outlines that the insurance company is responsible for paying

[34] Liikennevakuutuslaki 17.6.2016/460

[35] Finnish Motor Insurers' Centre Liikennevakuutuskeskus, Liikennevakuutuslaki 2017, www.lvk.fi/fi/vakuuttamisvelvollisuus/liikennevakuutuslaki/, (25.02.2017)

out the compensation for accidents that happen when the insurance policy is in force, however, under article 33 there is a list of exceptions in a case where two vehicles collide with each other on how the liability is determined. Under Article 33 the first vehicle's insurance is not liable to pay for the damages in the second vehicle, unless a condition in one of the three sub-sections is fulfilled. The three subsections are as follows; the first vehicle's insurance is not liable unless the damage was caused:

1. By the negligence of the owner, possessor, driver or passenger
2. Maneuver or location that is against the rules of traffic
3. Lacking vehicle condition or improper loading

The only exception to the subsections is that damages to people are initially covered by the vehicle insurance of the vehicle they were in, as either passengers or in the role of a driver, after which the damages will be divided between the insurance companies as regulated by article 51. What the articles 31-33 mean for Type B vehicles is that even if the "driver" cannot be held as the cause of the accident, and as such the vehicle itself caused the accident, there is no loophole in which no compensation is awarded for the damages that have occurred in the accident. Furthermore, article 51, which is concerned with the insurance companies dividing the damages, states that if the accident was solely caused by one vehicle's lacking, improper loading or neglect then the compensation will be paid by the insurance company that insured that vehicle alone. For a Type B vehicle this would mean that if it is in fact the sole cause of an accident, then the insurance company that insured the vehicle will be held liable for the damages of the accident and will be forced to recompense the victims damaged by the Type B vehicle's failings.

However, the insurance company that has been forced to pay for the accident caused by the Type B vehicle may be able to sue the manufacturer of the of the vehicle due to the right of redress, that is provided for the insurance companies under article 73, that bestows a right of redress to seek the amount compensated to the person suffering the damages from a third party with certain limitations when the third party is: an employee, private individual, public servant or any person that is comparable to such a role under the Damages Act 412/1974, the vehicle's driver, owner or possessor, in such cases the right of redress is bestowed on the insurer only if the accident was intentional or a result of gross negligence or if the driver was under the influence of alcohol or other impairing substance as outlined in article 48 of the TIA. Therefore, under article 73 it would seem that the insurer's of Type B vehicles would likely to try to recover the money they have paid out by attempting to attain redress from the manufacturer of the vehicle. Presumably,

lacking case law, article 73 would appear to be the consideration made for the introduction of autonomous vehicles, and situations where the driver cannot be held responsible for the incident, as mentioned before, this would be beneficial for the persons involved in the accident as they would be compensated promptly by the insurance companies who would then attempt to attain redress from the manufacturers under the product liability laws[36], and thus, it would mean that the introduction of Type B vehicles would have minimal changes for the average person occupying them, however the manufacturers of the vehicles may consider other insurance alternatives, should the lawsuits by insurance companies become common against them, such as insurance at the manufacturer whereby the manufacturer purchases one large policy covering its vehicle in for example one country at a time, naturally the costs would be passed down to the consumer which may have an unwanted effect on the price of purchasing a Type B vehicle[37].

2.1.1. Product liability law of Finland

Consequently in this context, a brief overview of the Finnish product liability law, the Product Liability Act 694/1990[38], henceforth shortened to PLA, is necessary. Article 1 (1) of the PLA states that the act is applicable to the compensation for injury and damages that has occurred from a product as a result of private use and that has been primarily used in such a manner. Article 2(1) and (2) narrow the scope further, and note that the Act does not apply to damage to the product itself (1) or damage to the product as a result of a component of that product failing provided it had been integrated prior to the product being placed into circulation (2). When the above two provisions are examined in the light of a crash of a Type B vehicle, there are several limitations that must be considered. The first of which is that the law offers much better protection for Type B vehicles that have been used by private individuals as opposed to companies or other commercial entities, interpreting the above criteria narrowly the worst case scenario would be that insurers would not be able to use the right to redress in cases where the Type B vehicle causing the accident was not in private use, i.e. in commercial use as for example a taxi or a carpool type of service. Moreover, a second limitation is that the damage to the vehicle itself, as it is the defective product would not be recoverable which may be a substantial financial sum, this may mean that insurance may become more expensive for Type B vehicles, especially for commercial use, however, that remains to be seen as it depends heavily on how

[36] Ibid 32
[37] Peterson, R. New Technology-Old Law: Autonomous Vehicles and California's Insurance Framework, Santa Clara Law Review, 2012, 52(4), pp 1342-1343
[38] Tuotevastuulaki 17.8.1990/694

frequent crashes caused by Type B vehicles actually are once they are introduced, and it may very well be that it is cheaper to insure a Type B vehicle than a Type A vehicle.

Proceeding with the PLA, article 3 sets out the standard, which must be breached, for liability to occur which is that the product was not as safe as could have been expected, considering when the product was put into circulation, the foreseeable use, the marketing of the product, its instruction manual and other circumstances. This provision may contribute to the "honeymoon" effect that may or may not occur with the introduction of the Type B vehicles, as it may well be that courts will be reluctant to hold manufacturers of Type B vehicles liable considering how new the systems are and as such it could be argued that it can be reasonably expected that they will contain faults that cause crashes, over time this type of protection that may be provided by courts, will likely fade as it will be considered that as the product has been on the market for a long time the issues ought to have been solved by that time[39]. Alternatively, manufacturers of Type B vehicles will print out manuals that demonstrate the probabilities of failure to the customer, at least in vehicles heading to the Finnish market, and as such aim to ensure that the expectation of the owner of the vehicle coincides with the vehicles actual abilities and as such avoids liability under article 3.

Section 4 of the PLA states that both the component and product shall be considered as having caused the damages if a defective component is present, in addition Section 4a bestows the burden of proof on the injured party to demonstrate a causal link between the defect and damages. For the purposes of Type B vehicles, this means that firms that provide individual components may be held liable should they fail and that the insurance companies will be the ones whom have to demonstrate that the defect is what caused the accident involving the Type B vehicle, this in turn, may well lead to insurance companies requiring Type B vehicles to have a "black box" type of system whereby it will be possible to determine the cause of an accident and if the accident was caused by a defect, which would allow the insurance company to mitigate their financial losses by suing the manufacturer of the Type B vehicle.

Article 5 lists the liable parties, the most relevant of which to Type B vehicles, are the manufacturer (a) and the party who imported the product to the European Economic Area (b). Conceivably, this could mean that firms that import for example American Type B vehicles may be held liable rather than the manufacturer, thus increasing the risks in such an endeavor.

[39] Graham, K. Of Frightened Horses and Autonomous Vehicles: Tort Law and Its Assimilation of Innovations, Santa Clara Law Review, 2012, 52(4), p 1271

The exemptions to product liability are outlined in article 7 of which most relevant for Type B vehicle cases are that the defect is attributable to compliance with a mandatory regulation by a public authority (2) or that the defect probably did not exist at the time the product was put into circulation (2). Subsection (2) has severe implications for accident categories A2, B2 and B3 as the manufacturer and possibly even distributors depending on who is sued will likely attempt to prove that the defect that caused the Type B vehicle to malfunction, and cause an accident was not present at the time of the production or sale. This could mean anything from attempting to prove that the vehicle was not maintained regularly or that the software was not up to date, which again increases the importance of the question of legislation regarding the software of Type B vehicles discussed in chapter 1.3 of this paper as this could be crucial to settling court cases in the future. Subsection (2) paragraph three of article 7 of the PLA allows for component producers to be exempted from liability if the defect was the result of the instructions given by the manufacturer of the product or the design of the product.

To summarize, the PLA appears less ready to handle cases involving Type B vehicles as it contains severe limitations, especially those in article 1 (1) whereby the scope of the Act is limited to products in private use only, which may cause issues when facing the reality of defective Type B vehicles in commercial use causing accidents and damages which the insurance companies will likely want to recover from the manufacturer.

2.1.1.2. Road Traffic Act of Finland

The next significant piece of legislation is the Road Traffic Act 267/1981, henceforth shortened to RTA, which regulates the use of all road traffic except for railway transport[40]. While the definition of vehicle in article 2 (1) is essentially the same as in the TIA and as such it applies to Type B autonomous vehicles without any issues, the RTA raises some issues when it comes to the introduction of Type B autonomous vehicles. For example, a "driver" is not defined within the RTA. Therefore, some clarifications regarding Type B vehicles would be convenient as there are multiple references to the duties and responsibilities of drivers such as caution during turns (article 12), yielding (article 14), and overtaking (article 17) among others. However, one article that may pose a significant challenge to Type B vehicle is article 23 that outlines that the vehicle's speed must be appropriate for the situation, especially if bad weather conditions apply, so that the driver is able to maintain control of the vehicle and that the vehicle can at all times be

[40] Tieliikennelaki 3.4.1981/294

stopped in the visible part of road in all foreseeable circumstances. Article 23 is likely to be a source of many lawsuits against manufacturers of Type B vehicles especially initially as complying with the appropriate speed in all circumstances requires a highly advanced processing unit and it is likely that one or more circumstances will arise were the software of the Type B vehicle will simply not yet be up to the task and result in an accident, which under the aforementioned product liability law may well end up costing the manufacturer.

The fact that the driver is not defined strictly in the RTA is a hindrance as it can be presumed not to include autonomous Type B vehicles considering some of the requirements outlined in the law, such as article 61 which requires the driver of a stopped vehicle to set a warning triangle at a suitable distance behind the stopped vehicle to warn other drivers. With the present concept of Type B vehicles it would appear that it is impossible for the Type B vehicle to comply with this demand absent a human stepping out of the vehicle and placing the warning triangle, and as such it can be inferred that driver in the RTA refers to a human. Furthermore, article 63 states that a person cannot drive a car if they are sick, injured or tired to an extent that they would not be suitable drivers, the aforementioned conditions are all quite clearly human afflictions that cannot be interpreted to influence the software of a Type B vehicle, and hence, it can inferred that the RTA's concept of a driver is human and as such it is not ready for the introduction of autonomous vehicles.

Arguably in the light of the current legislation, the question of who actually is the driver of a Type B vehicle remains somewhat open, as on the one hand the TIA makes preparations for accidents where no human is responsible thus implying that the occupants of the Type B vehicle would not be responsible for any accidents and as such could not be considered as the driver of the vehicle either, while the RTA has a human as the driver, owing to the fact that the RTA is older and as such autonomous vehicles were not a major concern when it was drafted, therefore, arguably the direction of the Finnish legislation using the *lex posteriori derogate legi priori* logic is that the concept of a driver is not necessarily one involving a person in the future. This is question is not unique to Finland naturally, and in other jurisdictions, such a Australia there is speculation on whether the manufacturer could be considered to be the operator of a Type B[41], if this is the direction that Finland chooses to proceed towards, it could additionally mean that the responsibility of the manufacturer of Type B vehicles would go beyond mere product liability cases in the future.

[41] Tranter, A. The Challenges of Autonomous Motor Vehicles for Queensland Road and Criminal Laws. QUT law review, 2016, 16(2), p 73

2.1.1.3. Vehicle Act of Finland

The final legal act and also the one which poses the biggest obstacles for Type B vehicles is the Vehicle Act[42], while the definition of a vehicle provided for in article 3 (1) is largely the same as in the previous acts, however article 4 (2) greatly complicates the situation for Type B vehicles, as it requires that the vehicle can be easily controlled in all circumstances, and have control devices which are placed so that they are easily accessible while driving. This part of article 4 (2) causes great issues for the Type B vehicle that has no form of external control devices such as a steering wheel and pedals available for the occupants of the vehicle, however, the final sentence of article 4 (2) mentions that the control devices shall not deviate as much to cause discomfort or danger from vehicles of the same category. Arguably therefore, if Type B vehicles are given their own category and none of the contain any control devices then there would be no deviation between them and as such this requirement of article 4 (2) would be technically satisfied. However, the first part of article 4 (2) would still be unfulfilled as there would be no steering devices in the vehicle.

The issue regarding the control devices is further described in article 25, whereby under article 25 (1) a vehicle is required to have a reliable steering device, this requirement could technically be fulfilled by a Type B vehicle with no external steering device in the cockpit as it does not require it to be accessible, only reliable and as such an embedded steering device that is not accessible to the occupants might fulfill the requirements of article 25 (1). Article 27 (2) throws a lifeline to Type B vehicles as it states that derogations from the provisions of the Vehicles Act for example for the control device and equipment of a vehicle may be granted by the Finnish Vehicle Administration provided they do not endanger road safety or distort competition. Therefore, such derogation may be required for Type B vehicles to avoid some of the awkward conflicts with the technical requirements of the Vehicle Act.

Article 9 (1) of the Vehicle Act states that either the vehicle owner or the holder entered into the register, as well as the driver, will be the responsible for the roadworthiness of the vehicle as well as its registration and inspection. When transferring this article to Type B vehicle as it means that the overall responsibility of the vehicle's condition lies with the owner or holder, as there is not a "driver" in the classical sense although it may lead to some complications with some of the obligations outlined in the Vehicle Act.

[42] Ajoneuvolaki 11.12.2002/1090

For example article 5 establishes the duty to repair a vehicle should it become defective or faulty and not use it in traffic before it has been fixed. However, there is an exception, in article 5, for insignificant defects or faults occur during a journey and that they could not have been repaired or noticed immediately by the driver. From the wording of article 5 it appears that this responsibility cannot really reasonably be delegated to the owner of the vehicle unless they are physically present in the vehicle. A reasonable way to overcome the requirement would be to have advanced enough self-diagnosis onboard the Type B vehicle so that the vehicle can itself reliably evaluate whether or not the faults or defects affecting it are insignificant or not, naturally there is a problem with this in the sense that if the defect is with the self-diagnosis unit and there is an additional failure it could potentially endanger other traffic. The issue of "unoccupied startups" was discussed in chapter 1.3 of this paper and as mentioned previously the extent of the capabilities for reliable self-diagnosis of the vehicle will be the key in establishing how well a Type B vehicle could potentially comply with article 5 of the Vehicle Act, however, there is the possibility of somewhat unjust liability for the owner or holder of the vehicle if the vehicle enters traffic when it is not roadworthy and it is unoccupied as the owner cannot using reasonable means ascertain the vehicle's condition, this problem would be further exacerbated in a car pooling type of system where the owner may never set foot in some of the vehicles in his or her fleet, and will only be able to either inspect them personally or have them inspected when they return to the garage, in a situation like that the car will be filled with persons who are not the driver and are unrelated to the car in all senses except that they happen to occupy it at the time and as such it is not clear if these passengers would have an obligation to inform the owner of the vehicle of any defects or faults they notice, as currently the legislation refers mainly to the driver's, owner's and holder's responsibility and not that of passengers.

Overall the Vehicle Act provides some obstacles for Type B vehicles in the technical requirements for vehicles, as it was not written with the possible introduction of autonomous Type B vehicles in mind, and as such it would benefit from an update similar to the TIA, however, while there are potential issues with the legislation and autonomous Type B vehicles it does not appear to provide insurmountable obstacles to the introduction of Type B vehicles.

2.2. International and supranational obligations

The reason why Finnish legislation remains so vague on the definition of a driver may lie with the international treaties Finland is a party to, as the Vienna Convention on Traffic article 1 (v) explicitly defines driver as any person who drives a motor vehicle[43]. Finland having signed the aforementioned convention in 1969 (and ratified it in 1985) would certainly explain why the RTA of 1981 would not need to define the concept of a driver specifically[44].

Now initially the Vienna Convention on Traffic would appear to pose a significant legal obstacle to the introduction of Type B vehicles, as it requires in article 8 (1) that every vehicle should have a driver, and using the definition of a driver from article 1 (v), the problem with Type B vehicles is obvious, however, an amendment that enables Type B vehicles to comply with the Vienna Convention on Traffic has been introduced and been in force since the 26th of March of 2016[45] and as such the Vienna Convention on Traffic no longer constrains Finland in introducing Type B vehicles.

Similarly article 8 of the Geneva Convention on Traffic, which Finland ratified in 1958[46] contains a similar requirement that every vehicle shall have a driver[47], however, it was recently amended with the Vienna Convention on Traffic and as such no longer poses an obstacle for Finland in introducing Type B vehicle to its roads[48].

Although the influence of unmanned technology has been subject to a great deal of debate as to its military implications in the form of drones and by that extension its influence on international humanitarian law as well potentially on the European Convention on Human Rights article 2 regarding the use of force should armed drones be used outside the military[49], the implications Type B autonomous vehicles may have on several other human rights has perhaps not received as much attention. As Type B vehicles are yet to be introduced it is difficult to predict exactly

[43] Vienna Convention on Road Traffic 1968
[44] United Nations Economic Commission for Europe, List of Contracting Parties to the Convention on Road Traffic, www.unece.org/fileadmin/DAM/trans/conventn/CP_Vienna_convention.pdf , (25.02.2017)
[45] United Nations Economic Commission For Europe, UNECE paves the way for automated dirving by updating UN international convention, www.unece.org/info/media/presscurrent-press-h/transport/2016/unece-paves-the-way-for-automated-driving-by-updating-un-international-convention/doc.html, (25.07.2017)
[46] United Nations, Convention on Road Traffic, treaties.un.org/doc/Publication/MTDSG/Volume%20I/Chapter%20XI/xi-b-1.en.pdf, (26.02.2017)
[47] Geneva Convention on Road Traffic 1949
[48] United Nations Economic Commission for Europe, Report of the sixty-eight session of the Working Party on Road Traffic Safety, www.unece.org/fileadmin/DAM/trans/doc/2014/wp1/ECE-TRANS-WP1-145e.pdf, (26.02.2017)
[49] Oagallo, U. Guns, Ships, and Chauffeurs: The Civilian Use of UV Technology and its Impact on Legal Systems, Journal of Law, Information and Science, 2011, 21(2), p 226

how and which human rights will actually be affected, however, it is possible to reasonably speculate on some potential human rights issues that may arise from Type B vehicles and are such that they would have to be taken into account by the signatories of the treaties which contain the rights that are threatened.

One of the most obvious candidates for the human right to be potentially violated by Type B vehicles is the right to privacy, which in the case of Finland is present in the European Convention on Human Rights, henceforth ECHR, Article 8[50], which Finland signed in 1989 and ratified in 1990[51], as well as article 17 on the International Covenant on Civil and Political Rights[52], henceforth ICCPR, signed by Finland in 1967 and ratified in 1975[53]. Furthermore as a EU member Finland is additionally bound by the Data Protection Act and in the future the revised General Data Protection Regulation, which regulate privacy in the form of protecting private data, the former, already raises some issues with autonomous vehicles in the potential for misuse of the location data in the vehicles regarding the passengers destinations[54].

However, the potential for the violations to privacy with autonomous vehicles is not limited to location data but extends to for example private conversations in the vehicle using the in-built microphone[55], consequently it is important that due consideration is given to the cyber security requirements of the vehicle in addition to the more traditional mechanical safety requirements and implement them into the regulations at an EU levelm such as into the General Safety Regulation 661/2009[56] for cars in the EU. Naturally, these types of privacy concerns are not unique to Type B vehicles, as many Type A vehicles are becoming more and more interconnected and as such more vulnerable to the aforementioned eavesdropping.

Furthermore, it is likely that the EU will produce some form of legislation settling the liability questions that surround Type B vehicles in the future, as it is crucial for the cross-border use of the Type B vehicles within Europe, which in turn is important for the freedom of movement

[50] European Convention on Human Rights
[51] Council of Europe, Chart of signatures and ratifications of Treaty 005 www.coe.int/en/web/conventions/full-list/-/conventions/treaty/005/signatures?p_auth=ydNJvEWV, (26.02.2017)
[52] International Convent on Civil and Political Rights
[53] United Nations Human Rights Office of the High Commissioner, Status of Ratification Interactive Dashboard, indicators.ohchr.org/, (26.02.2017)
[54] Holder, C., Khurana, V., Harrison, F. Robotics and law: Key legal and regulatory implications of the robotics age (Part I of II), The International Journal of Technology Law and Practice, 2016, 32(3), p 392
[55] Stephen Checkoway et al., "Comprehensive Experimental Analyses of Automotive Attack Surfaces," in USENIX Security Symposium, San Francisco, 2011, p 14
[56] Regulation (EC) No 661/2009

within the EU[57]. Therefore, it is no surprise when Members of the European Parliament are currently requesting the Commission to harmonize the insurance schemes and liability rules for autonomous vehicles in Europe[58], however it remains to be seen which is first introduced, EU wide rules for Type B vehicles or the Type B vehicles themselves.

As mentioned in chapter 1.2 of this paper, hacking attacks towards persons in Type B vehicles could most likely be targeted towards specific individuals as well as random targets. The former of the two is more relevant when discussing potential human rights issues that may arise with Type B vehicles, for example, considering the aforementioned possibility of eavesdropping conversations in vehicles and combining that with the potential tracking of the location of a vehicle it would not be too difficult for a hacker to confirm that their intended target is in fact in the vehicle, as they would most likely be able to see from where the vehicle began its journey and then by eavesdropping confirm that their intended victim is in fact in the vehicle. The potential for human rights violations occurs in the aforementioned scenario when the intended target of hacking of the Type B vehicle is a person who is targeted for their religious, political views or other held beliefs, and should attacks targeted towards such persons become commonplace or even simply viable, it could lead to a situation where people in a society would be afraid to speak their mind and as such it would mean that they would not benefit from the rights in articles 9 and 10 of the ECHR.

As Type B vehicles are yet to be introduced it remains to be seen if political dissidents and other vulnerable persons who are in the public eye will face the terrifying prospect of being injured or killed via cyber attacks to their Type B vehicle, the death of journalist Michael Hastings in a car accident raised the speculation of whether his car was hacked and made to crash, to stop his investigation. While it has never been proven conclusively that his car was hacked, former U.S National Coordinator for Security, Infrastructure and Counter-Terrorism voiced his concern in relation to the incident that there is reason to believe that certain intelligence agencies would already be able to carry out such an attack[59]. Before there is conclusive evidence of such an attack, this type of threat to the human rights of people in societies with Type B vehicles remains

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[57] Schellekens, M. Self-driving cars and the chilling effect of liability law, Computer Law & Security Review: The International Journal of Technology Law and practice, 2015, 31(4), p 514

[58] European Parliament, Robots: Legal Affairs Committee calls for EU-wide rules, www.europarl.europa.eu/news/en/news-room/20170110IPR57613/robots-legal-affairs-committee-calls-for-eu-wide-rules, European Parliament, (26.02.2017)

[59] Hogan M. Was Michael Hastings' Car Hacked? Richard Clarke Says It's Possible www.huffingtonpost.com/2013/06/24/michael-hastings-car-hacked_n_3492339.html, Huffington Post, (26.02.2017)

speculative, however, should it ever materialize the prevention of such attacks would likely prove difficult, as even if high risk targets in a society were granted better software that is more resistant to hacking, it would not protect them from the Type B traffic around them which could be hacked, and for example a vehicle on the oncoming lane might collide with the target's vehicle at high speed with devastating effects. However, for the moment the scenario is merely one possibility of what may occur in the future.

Chapter 3: Analysis of liability in accidents

3.1. Analysis by accident category

For the purposes of this analysis, the accident analyzed will be assumed to have been caused entirely by a Finnish Type B vehicle and it involved damage to another Finnish vehicle that did not contribute to the incident by its actions.

In an accident of category A1 where a Type B vehicle causes an accident due to a hardware defect and thus causes damage to another vehicle, the Finnish TIA, owing to its considerations to the possible future introduction of Type B vehicles, is fairly capable of solving the liability issue that arises. Under article 31 of the TIA any accident will be compensated even if nobody is personally liable, and as such in an A1 accident the occupants of the Type B vehicle could not have influenced the trajectory of the vehicle and as such cannot be considered responsible or liable. The important distinction is that in the A1 category there is no end user negligence in for example the maintenance of the vehicle, and in this category therefore, the owner or operator of the vehicle is blameless. Due to this, under article 51 concerning the division of costs between insurance companies, the insurer that insured the at fault Type B vehicle will be liable to pay for all the damages under the provision that if the lacking condition of one vehicle solely caused the accident, then the insurer of that vehicle must pay for the damages. Therefore, there is no great confusion as to this type of a situation in the law, most likely the insurer forced to pay for the failure of the Type B vehicle will then resort to the right of redress under article 73 and attempt to recoup at least some of the money it was forced to pay out from either the manufacturer or distributor of the Type B vehicle under the product liability laws, whether or not this can be done when the vehicle at fault in the accident was not in private use remains to be seen as well as the overall eagerness of the courts to hold the manufacturers liable.

In category A2 the Type B vehicle crashed due to a failure of a component attributable to the owner or holder's negligence, as they are under the Vehicle Act responsible for the roadworthiness of the vehicle as there is no driver, in this situation the liability would again be determined very similarly to the above situation in the sense that again the at fault Type B vehicle's insurer will be the one paying for the damages under article 51 as the this time the owner of the vehicle was at fault and that it was their negligence that caused the crash, as required by article 51. The ability of the insurer to use the right of redress under article 73 will

depend on the level of neglect involved as gross negligence is required for the insurer to be able to use the right of redress against the owner or possessor of the vehicle. The exact circumstances of what the courts of the future will consider gross neglect of a Type B vehicle remains to be seen especially as mentioned previously in relation to "unoccupied startups" the actual capability to assess the roadworthiness of the vehicle would largely have to be done by the vehicle itself, as the owner or holder of the vehicle may not be present and as such not be able to assess the vehicle's condition in many instances when the vehicle leaves for traffic or is in traffic.

3.1.1. Accident category B

An accident in category B1 involving a software defect with no other influences from the owner or possessor of the vehicle would essentially be treated under the TIA exactly the same as category A1 but merely with a different cause. The result would be the same whereby the insurer that insured the Type B vehicle will have to pay the damages alone under article 51 and will likely attempt to recoup some of the money paid out from the manufacturer or distributor of the Type B vehicle with a lawsuit using the product liability laws as the insurer will be entitled to do under article 73 of the TIA.

Category B2 is more complicated than the issue of the mechanical maintenance of A2 as the software within a vehicle is regulated poorly when compared to the mechanical parts of the vehicle, which are extensively regulated by the Vehicle Act. For example, article 5 which requires any defect or fault in the equipment or construction of the vehicle to be repaired, however, the word equipment or construction is not defined explicitly in the legislation and it is not clear whether or not the software governing a Type B vehicle can be considered either to be a part of the construction of the vehicle or equipment of the vehicle, and moreover even if the software controlling the car could be considered as a part of the construction or equipment of the vehicle, article 5 would still only require defects and faults to be repaired, which is perfectly fine when mechanical items are concerned, however, arguably it is a form of neglect if the software controlling the car is not updated as the software updates would likely contain crucial improvements to the functioning and security of the vehicle, and as such the lack of a requirement in the law to update the vehicle software is a major issue.

Therefore, if the accident is a result of a bug that subsequent and available software updates would have fixed, and as such the accident could not have happened using the latest software update, it is unclear whether or not this could actually be considered neglect under the current

Vehicle Act, as on the one hand an outdated software could be considered a defect in itself but the concept of a defect is not defined in the legislation so this would largely be up to the courts to decide whether or not article 5 could be interpreted in a way that would require users to update the software in their vehicle as lacking the current software would mean the vehicle's software is defective and as such must be addressed under the obligation to repair the vehicle in article 5.

Assuming that not updating the software of the vehicle can be considered a form of neglect on the owner's or holder's part, then the liability in an accident with the outdated software containing Type B vehicle would proceed similarly to category A2 and again it will be an issue of how neglectful is foregoing the updates of the software to a Type B vehicle as if it can be considered gross negligence then the insurer could use its right of redress against the owner or holder of the vehicle. However, presumably there would be some form of an order of magnitude as to the level of neglect of not updating the software i.e. if the software has not been update for under a year, cannot be considered gross neglect whereas if the vehicle software has not been updated for a year or more then it can be considered as gross negligence.

Accident category B3 raises further issues in the current Vehicle Act as under article 7 (1) which concerns modification of the vehicle construction, more specifically that the construction of the vehicle is not to be modified subsequent to it being used in traffic, in a manner that would make it contrary to the relevant requirements with an exception being provided for a decree by the Ministry of Transport and Communications. Again a central issue at hand is what exactly is the construction of a vehicle, as it is not defined in the legislation explicitly. However, there is a reference in article 7 (1) to a situation where 50 % or more of the original parts on the vehicle have been replaced, which requires the vehicle to be registered as a built or built and modified vehicle, in this light it would appear that construction excludes the software part of the vehicle. Moreover, interpreting article 7 (1) in the light of end-user software modifications in this case by the owner or holder of the vehicle, they would never have to be subject to the type of registration inspection as a vehicle with 50 % or more of its parts replaced, as any modifications installed to the onboard software would not actually require new physical parts to be replaced or introduced into the vehicle. On the other hand article 7 (2) allows for decrees by the Ministry of Transport and Communications, which can concern the modification of vehicle structures, such a decree could potentially clarify the situation as to the regulation of software modifications by the owner or holder of a Type B vehicle.

Until the end-user modifications to the vehicle software are better regulated, a crash involving a Type B vehicle due to the aforementioned software would be treated similarly to categories A2 and B2, whereby the Type B vehicle's insurer would be required to pay out the compensation under article 51 of the TIA. The same question of whether modifying the software onboard the vehicle can be considered as gross negligence remains as open as in the previous categories as there is no case law as of yet, however it is an important question as it is crucial in determining whether or not the insurance company is able to use the right of redress against the owner or holder of the vehicle for the modifications under article 73 of the TIA.

3.1.1.2. Accident Category C

There are a multitude of external circumstances that may cause a Type B vehicle to crash such as animal collisions, harsh weather or poor road condition and each has to be examined separately. As mentioned previously in 1.3.1.3, it is likely that Type B vehicles will reduce the amount of animal collisions, but will not eliminate them completely as it would appear probable that it is possible for an animal to suddenly jump into the path of a Type B vehicle with no chance to either maneuver and avoid or stop the vehicle before a collision. Rare as such situations may become, the already familiar article 31 of the TIA would mean that the insurance company would compensate for the accident, as nobody is personally responsible. If another vehicle is also damaged then the costs between the two insurers would be divided according to article 51 of the TIA as in previous cases. However, the question of whether the insurers would be able to use article 73 of the TIA and by that extension use the PLA to attempt to recoup the compensation they paid out from the manufacturer appears to be far more difficult than in previous accidents categories, as proving that the requirement of article 3 of the PLA regarding the Type B vehicle failing to meet the expectation of safety for the product, as there may well be cases where avoiding a collision is simply not possible due to the laws of physics and applying the *lex non cogit ad impossibilia* principle it would appear that the chances of the insurer bringing a successful case against the manufacturer would remain slim in a purely C1 type of animal accident. However, if there is a C1 type of animal accident with a combination of either hardware failure (A1) or (B1) software failure, or both, then the odds may change to favor the insurer.

In the event of a Type B vehicle causing a collision due to harsh weather, the situation becomes somewhat more complicated as under article 23 of the RTA, it is required that the speed of the

vehicle be matched to the weather, road condition and visibility as well as the speed should at all times be such that the driver maintains control of the vehicle. As mentioned in section 2.1.1.2 the RTA is an older piece of legislation and poses issues regarding the definition of a "driver", this is especially problematic as the phrasing of article 23 is such that the second sentence puts the responsibility of driving at a controllable speed explicitly on the driver, therefore, it is not clear in practice who would be held responsible if the Type B vehicle would cause an accident due to driving at a speed where it loses control owing to the external circumstances.

Moreover, the reference to the visibility is somewhat more complicated with Type B vehicles, as visibility is easy to assess with a human driver as human eyesight is hindered by factors such as fog and darkness, however, it must be noted that the sensors of a Type B vehicle would likely perceive the world differently to that of a human eye. For example, the LiDAR system currently being tested by Ford would allow a Type B vehicle to "see" as well in the dark as they would in perfect weather conditions using infrared laser beams[60], therefore, whereas a human driving a car would be, by law, required to slow down, a Type B vehicle would not necessarily detect any real difference in its operating environment as its capacity to detect its surroundings remains the same. Therefore, there is a question of how the law will be applied to Type B vehicles, will the standard of perception they will be held accountable for be the human equivalent, or what that particular Type B vehicle would be capable of detecting, this question will likely remain open until new legislation or case law emerges.

However, the basic accident framework remains the same as before, if the Type B vehicle veers off the road due to harsh weather or bad road condition, the accident will be compensated as required by article 31 of the TIA as before. If another vehicle is involved, then the insurer of the Type B vehicle may have to compensate for its damage as well under article 33 (2) of the TIA if the RTA article 23 is interpreted in such a way that the Type B vehicle was operating contrary to the requirements of the law in the external conditions at the time, the division of compensation between the insurers will be determined by article 51 of the TIA as in previous cases. The ever present question of the right of redress for the insurer in article 73 is difficult to assess before the question regarding the "driver" of a Type B vehicle is conclusively solved as for example mentioned in 2.1.1.2 regarding the Australian possibility of the manufacturer being considered the operator or driver of the Type B vehicle, it could open the door for cases where the insurer

[60] Wittman, No Lights? No Problem! Ford Fusion Autonomous Research Vehicles Use LiDAR Sensor Technology To See In The Dark, media.ford.com/content/fordmedia/fna/us/en/news/2016/04/11/no-lights--no-problem--ford-fusion-autonomous-research-vehicles-.html, Ford Motor Company, (15.04.2017)

goes after the driver using Article 73 and the PLA as article 3 of the PLA would likely be satisfied as it can be reasonably expected that the vehicle should be able to comply with the traffic laws if it is sold to the public, and thereby if it has violated article 23 of the RTA it may be considered defective and hence the insurer may be able to bring a successful case against the manufacturer.

The accident category of C2 involving purposeful crashing using hacking of the Type B vehicle is from a liability point of view rather simple, the criminal aspects and specific charges will not be examined in this paper. Even if the hacker is never found, article 31 of the TIA requires that the accident be compensated, moreover, when another vehicle is damaged due to the collision the insurer of the responsible Type B vehicle will be liable for the damages of the other vehicle as article 33 (2) of the TIA will be fulfilled in most, if not all conceivable cases whereby the responsible Type B vehicle either drives against the traffic rules or is incorrectly placed on the road. Article 51 of the TIA will be used similarly to previous cases, and article 73 will likely be used against the hacker if they are found and possibly against the manufacturer also if a software defect (B1) that allowed for unreasonable vulnerability to hacking was present.

The category of C3 is from the liability perspective almost identical to C2 as the only major difference is that it is not hacking that caused the Type B vehicle to crash but rather a purposefully placed obstacle or other criminal influence such as purposeful modification of a Type B vehicle to cause it to crash to for example harm the occupants.

Chapter 4: The road towards manufacturer responsibility?

4.1. Strict liability and general aviation

As possibility to seek redress from the manufacturer appears to exist in several of the likely accident types examined in Chapter 3, it is prudent to examine what the likely impacts of such legislation would be in practice. While the current PLA does not really allow for strict liability by the strict definition, that the manufacturer would be made responsible for the product despite their efforts to make it reliable[61], the law most likely will allow more cases to be brought against the manufacturer than currently, as there is no more room for human error on behalf of the driver to absorb the responsibility for crashes.

In the United States, since the 1960s the legal system began to adopt a stance of strict liability, which had drastic effects on the general aviation industry, for example liability expenses (for the manufacturer) increased by 775 % in 10 years, the sales of new aircraft reduced by 90 % and the age of the general aviation fleet increased[62]. Moreover, the change to strict liability drastically increased the price as for example in 1986 liability costs alone added roughly 75 to 80 000 dollars to the cost of an aircraft, and the price increased in general from 46 105 dollars in 1978 to 181 445 dollars, whereas the human cost of the change in the legal system was a 25 to 35 % increase in the accident rate[63].

The impact strict liability had on general aviation has several implications for Type B vehicles, as both goods are fairly long lasting, presuming Type B vehicles have a service life comparable (or possibly longer) than current cars, as the average age of the genera aviation fleet in the United States is 34 years[64] and in Finland the average age of the car fleet is 11.3 years[65], while the general aviation fleet is almost three times as old as the average Finnish car, it is clear both products, aircraft and cars can last a long time, and as the mentioned before the age of the general aviation fleet increased due to the strict liability legislation and therefore it may represent how the average age of cars may also increase in the future if similar legislation is applied.

[61] Cardinali, R. If the system fails, who is liable?, Logistics Information Management, 1998, 11(4), p 259
[62] Nelson, R., Drews, J. Strict product liability and safety: evidence from the general aviation market, Economic Inquiry, 2008, 46(3), p 425
[63] Ibid pp 428-436
[64] Ibid p 426
[65] Finnish Transport Safety Agency Trafi, Henkilöautojen keski-ikä yli 11 vuotta – harmaa edelleen yleisin väri, www.trafi.fi/tietoa_trafista/ajankohtaista/3820/henkiloautojen_keski-ika_yli_11_vuotta_-_harmaa_edelleen_yleisin_vari, (15.04.2017)

The effects of the United States' legislation regarding strict liability for general aviation aircraft has many implications for Finnish lawmakers when it comes to the liability questions of Type B vehicles. As the effects of allowing insurers to seek redress from the manufacturers only in some cases even without introducing strict liability *per se,* may produce similar or worse effects on the car industry as they did on the US general aviation fleet due to sheer numbers of vehicles involved. This is due to the fact that in the United States in 1986 the general aviation fleet consisted of 205 300 aircraft, and it is currently sized at around 224 475 aircraft[66], while in Finland, which is by far a smaller country in terms of population, has over 3 million cars on the road and 5 million if all vehicle categories are included[67], therefore, while in the above case of the general aviation strict liability was applied to each and every one of the around 200 000 aircraft, the results of applying manufacturer responsibility by insurers seeking redress via the PLA to over 3 million cars in even select cases, such as outlined in the accident categories of Chapter 3 of this paper, may well produce a similar effects on the safety, industry and prices of Type B vehicles as it did to general aviation in the United States.

Therefore, despite perhaps initially seeming far fetched and a false analogy due to the perceived differences in the products in question, the legal system and the legislation the case of the effects of the strict liability legislation on general aviation should not be overlooked when mapping out the potential practical implications of the liability laws in Finland regarding Type B vehicles, as they provide valuable insight into a situation where the manufacturer of a long lasting product is faced with considerable liability related lawsuits, and by that extension, expenses. As mentioned in the first chapter of this paper, the Type B vehicle is likely to be safer than a Type A vehicle, especially one absent any technological assistance, the artificial reduction of the potential safety benefits via legislation such as in the case of the general aviation, are highly undesirable as the perceived and expected improvement in safety is one of the key expected advantages of Type B vehicles, and likely one of the key selling points to the public, however, if they are too expensive due to the manufacturers paying the liability costs, it is likely cheaper Type A vehicles will remain popular and Type B vehicles risk becoming a vehicle for commercial entities and wealthy individuals, while the section of the public wishing to own a personal vehicle will be forced to stick to Type A vehicles.

[66] AOPA, Active General Aviation Aircraft In The U.S, www.aopa.org/about/general-aviation-statistics/active-general-aviation-aircraft-in-the-u-s, Aircraft Owners and Pilots Association, (15.04.2017)
[67] Finnish Transport Safety Agency Trafi, Henkilöautojen keski-ikä yli 11 vuotta – harmaa edelleen yleisin väri, www.trafi.fi/tietoa_trafista/ajankohtaista/3820/henkiloautojen_keski-ika_yli_11_vuotta_-_harmaa_edelleen_yleisin_vari, (15.04.2017)

Chapter 5: Conclusion

5.1 The current Finnish legislation

The current Finnish legislative framework relevant for the liability issues created by Type B vehicles and Type B vehicles in general is a combination of a few key acts most of which were written well before Type B vehicles had to be considered in any significant manner, and were more or less restricted to science fiction. Naturally, this is reflected in most key acts such as the Road Traffic Act, which contains somewhat problematic articles for Type B vehicles such as article 23 which is especially relevant for the C1 accident category involving collisions due to external circumstances, in addition the technical requirements for road going vehicles required by the Vehicle Act such as a reliable steering device as mandated by article 25 (1) create further potential legal issues for Type B vehicles in Finland, however, as mentioned in the second chapter of this paper the issues can be overcome with relatively minor amendments to the wording and content of the key articles that cause conflict with the concept of a Type B vehicle.

The most recent legal act reviewed in the second chapter of this paper, the Traffic Insurance Act, which has been designed with the future introduction of autonomous vehicles in mind, is naturally also the least problematic within the topic of Type B vehicles on Finnish roads. Moreover, as it is the single most important legal act in determining the liability questions examined in this paper, that may be caused by Type B vehicles in the future, it is responsible for the relative ease of solving the liability issues of the various accident types which involve Type B vehicles analyzed in the third chapter of this paper, with a combination of a few key articles that made the solving of the liability issues formulaic, and therefore simple, despite the different nature of the accident categories.

However, the newer Traffic Insurance Act is intimately connected with the much older Product Liability Act in the topic of Type B vehicles, as the former has been purposefully written in a way to open the door for product liability lawsuits against the manufacturers or importer to the EAA, as mentioned in article 5 of the PLA. This is problematic as the PLA is older and it provides much better protection to private individuals due to the restrictions in article 1 (1) and by that extension, to private Type B vehicles than their commercial equivalents. The PLA was not drafted with the concept of liability issues created by autonomous vehicles in mind, as it is over 25 years older than the updated Traffic Insurance Act, and as such the new and revised TIA

relies on a considerably older legal act that is not entirely fit for the new intended purpose of settling Type B vehicle cases, as it was not drafted to handle them.

Therefore, the easiest and simplest way to summarize the current Finnish legislative framework for Type B vehicles, and the liability issues created by them, is one legal act that has been revised and purposefully drafted to include Type B vehicles, the TIA, surrounded by considerably older legal acts that manage to somewhat accommodate Type B vehicles, however, they were certainly not drafted to handle these issues, and thus contain somewhat out-of-date legal requirements and solutions which ought to be revised. Thus, the key issue that Finnish legislators must tackle in the years leading up to the large scale introduction of Type B vehicles into traffic is the revising and updating of the legal acts that surround the TIA and vehicles in general, or alternatively pass a new act entirely devoted to Type B vehicles that will solve the liability issues and technical requirement questions raised by the current legal framework.

It must be mentioned however, that during the analysis of the likely accident categories, the actual liability issues were easily solved for all categories and sub-categories, at least initially thanks to article 31 of the TIA, which provides for compensation even if nobody is personally responsible for an accident, the issues start to truly arise when and if the insurer decides to use the right of redress given by article 73 of the same act, and then the potential usage of the outdated PLA against the manufacturer. Moreover, the question about accident category B2 whereby the end-user has failed to update the software of the Type B vehicle, which is not explicitly required by Finnish law at the moment, and category B3 where the end user has modified the software but not in a way as to cause it to crash on purpose, which again is not regulated by the Vehicle Act at present, is crucial for redress under article 73 of the TIA, which requires gross negligence by the end-user for the insurer to be able to use the right of redress against the end-user.

Overall, it must be mentioned that the current legal framework is fairly capable outside the scope of article 73 of the TIA, regarding the right of redress, and at present it would likely provide sufficient protection at least to private users and owners of autonomous vehicles, however it would appear that this is done potentially at the cost of either the insurer or manufacturer as the private end-user is fairly well protected due to the lack of laws for example requiring updating the software of vehicles.

As the actual large scale introduction of Type B vehicles is still in the future at the time of writing of this paper, and the actual final technological set up of the vehicles is still somewhat

unclear, it does not seem viable however, to make any large scale revisions to the Finnish legal acts despite some of them being rather outdated, until just prior to the introduction of Type B vehicles on to the Finnish market and by that extension, Finnish roads. This is especially true for the Vehicle Act as it lays down fairly detailed technical requirements for vehicles on Finnish roads, and it would appear that an attempt to essentially predict what those requirements ought to be in great detail before there are any actual Type B vehicles are ready to be sold to the public are available, would likely be a wasted effort that could result in widely inappropriate legislation regarding Type B vehicles.

However, the fact remains that the legal framework concerning Type B vehicles, barring the TIA ought to be revised, however, the timing should be such that the revision is done just before the public is able to buy Type B vehicles, and that the legal framework would be clear and explicit on the topic of Type B vehicles, allowing for better legal certainty as there were more than a few open questions that remain somewhat unanswered in this paper, which would in turn reduce anxiety the public may have about legal questions related to Type B vehicles, and as the revision would take place very close to the actual introduction, the legal requirements and laws would be drafted in accordance with the actual technology at the time rather than predictions, and thus hopefully be more accurate and fit for purpose.

While there are no concrete examples from the world of how liability issues created by Type B vehicles have been solved on a large scale, as there is no country where Type B vehicles have been introduced on a large scale, the case study of the the introduction and shift into strict liability in the United States and its effect on general aviation should be considered very seriously by Finnish lawmakers, as currently the TIA has purposefully opened the door for product liability cases concerning Type B vehicles and as such while it is not a move to strict liability in the exact sense, it may well produce similar effects due to considerations outlined in the fourth chapter of this paper.

The case study is especially important as the products are closely comparable, they are both long lasting and both are primarily used for transporting people, therefore the case study is an excellent warning from the past of how inappropriate liability legislation has not achieved its intended purpose, but rather resulted in a decline of safety for the persons using that particular method of transport and also negatively affected the manufacturers of the goods due to the drastically reduced sales.

Naturally, it must be recognized that it is highly unlikely that Finland will be the only, or even the key market for Type B vehicles in the future, owing to its fairly small population and as such it is unlikely its legislation would be capable of producing as drastic effects on the manufacturers of Type B vehicles, especially as there is not a domestic industry for producing such vehicles at the moment. However, should an inappropriate and most of all costly, for the manufacturer, legal framework for Type B vehicles be introduced to Finland, the country would risk being isolated from spread of Type B vehicles if manufacturers consider selling Type B vehicles as too risky due to product liability lawsuits under the PLA or alternatively if the manufacturers compensate for the potential lawsuits by selling Type B vehicles at a considerably higher price on the Finnish market, which would alienate the customer base and essentially ensure they would prefer Type A vehicles. Of course both scenarios, especially the latter do not take into account the internal market of the EU, and as such it would appear unlikely that no Type B vehicles would find their way to Finland.

5.1.1. External considerations and overall conclusion

There is of course one giant elephant in the room in terms of the analysis done in this paper, which was briefly mentioned in section 2.2 of this paper, which is any and all potential EU legal acts on the topic of Type B vehicles. As mentioned in section 2.2 of this paper, autonomous vehicles represent a cross border issue, and as such it is more than likely that the EU will respond in some manner to make sure that there are no unjustified obstacles for the free movement of Type B vehicles within the EU.

A directive on the topic of Type B vehicles would certainly set the tone and direction for future Finnish legal acts on the topic, which further adds to the aforementioned recommendation for the Finnish lawmakers to wait until the actual introduction of Type B vehicles is closer to reality, as that way it is likely that the EU will have conveyed its intended actions regarding the topic of Type B vehicles, which would avoid an awkward situation in which Finland revises its legal framework well before both the introduction of Type B vehicles and any EU action, and is then forced to revise it again to comply with the EU requirements. Moreover, if the EU passes for example a definitive regulation on solving the liability issues created by Type B vehicles, it may even be that the current TIA will have to be revised in the future, consequently, it would be prudent not to revise the current legal framework that would influence Type B vehicles any further for the moment, and wait until the last reasonable moment before the large scale introduction of Type B vehicles.

The likely EU wide legal action by the European Union on Type B vehicles and especially the liability issues created therein poses a similar scenario as outlined in the last paragraph of section 5.1, whereby if the legal framework introduced by the EU regarding Type B vehicles results in a similar situation as in the general aviation case study, it might well result in the EU becoming isolated from the spread of Type B vehicles due to essentially either of the scenarios outlined in the last paragraph of 5.1 on an EU wide scale. Consequently, the case study in the fourth chapter on general aviation ought to be recognized not only on a national scale but also at an EU level, as it is a prime example of what practical effects either strict liability or laws producing a situation that approach strict liability in its capacity to produce lawsuits against the manufacturer may have.

In conclusion, while Finland's own national legislative framework requires revision in its older legal acts regarding Type B vehicles, its newest revision in the form of TIA is quite capable of solving the immediate liability issues created by Type B vehicles, and as such, limitations arise only when other legal acts are concerned, despite this, it would be prudent not to revise the legal framework further until both the technology develops and the EU has introduced the legal measures it intends to taken on the topic in detail, moreover, when the legal framework in Finland will eventually be revised it would be equally sensible to learn from the past, such as in the case of the general aviation market in the United States.

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