

## Discussion of Tort Liability of Self-Driving Vehicles

Xu Qinyi

Law Department, Zhongnan University, China

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**Abstract:** With the advent of "Artificial Intelligence +" era, the development of Artificial Intelligence has a profound impact on people's production and life style, and has penetrated into education, medical care, pension, environmental protection, transportation, public service and other fields. At the individual level, disputes over damages caused by artificial intelligence continue to arise. At the national level, artificial intelligence has become an important part of the development strategies of many countries, and is also an important area in which countries compete in economy and science and technology at present and in the future. So far, the growth and reproduction of any new industry need the cooperation and support of law, and the related legal mechanism must be perfected, which is an important part of the legal regulation of the damage caused by artificial intelligence. The characteristics of AI itself, such as independence and unpredictability, mean that we must re-examine and perfect the legal regulation of AI damage on the basis of the existing legal system.

**Keywords:** Artificial Intelligence; Self-driving Cars; Tort Legal System

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### I. INTRODUCTION

#### 1. Status Quo

- (1) The current state of technology for autonomous vehicles
- (2) The development status of autonomous vehicles in various countries
- (3) Current status of autonomous vehicle legislation

#### (1) The current state of technology for autonomous vehicles

In recent years, self-driving cars have received extensive attention from industry and academia due to their safety, strong transportation capabilities, and intelligence. Autonomous vehicles are composed of sensors, GPS, navigators, on-board computers and other hardware devices and software systems, and their structure is very complex. Sensors are used to detect and perceive other vehicles, and receive information about road conditions, traffic flow, and weather conditions, instead of human drivers to obtain various driving information; the on-board computer will maintain all aspects of vehicle operation through algorithms and other computing software, such as planning arrival. The best route to the intended destination, instructing the vehicle to react to the danger encountered in driving, etc. With the gradual development and maturity of artificial intelligence technology, the software system of self-driving cars simulates the decision-making mechanism of human drivers and possesses the attributes of "anthropomorphism". It can make important decisions related to vehicle control actions, including driving, acceleration, braking, and vehicles. Positioning, route selection, compliance with traffic rules, identification of traffic signs and signal lights, etc., through the "Sense-Plan-Act" (Sense-Plan-Act) operating procedure, to achieve completely autonomous decision-making.

#### (2) The development status of autonomous vehicles in various countries

##### A. United States

##### B. Japan

##### C. European Union

##### D. Singapore

##### E. China

**A.** Google, which launched its self driving project in 2009 and its concept car in 2014 with no steering wheel or brake pedal, has been working on the highest level of self driving systems in recent years. Elon Musk, the founder of Tesla, announced in late 2019 that it would soon be fully autonomous, with a new product that would free both hands from the steering wheel, it's self-driving from New York to Los Angeles.

**B.** Japan's government, in collaboration with other agencies, has long pushed for self-driving programs, allowing fully autonomous passenger cars to hit the roads in some areas in 2019.

**C.** The EU launched the "Adaptive" programme in 2014 and has issued a series of policies to encourage member states to continue to promote the development and application of self-driving cars. Germany pioneered the concept of self driving cars, which were field tested on highways, urban and rural roads in 2014.

**D.** in August 2014, in order to maintain order in the national research and testing of self-driving cars, Singapore established the self-driving Cars Initiative Committee to oversee the administration. Two years later, Nutonomy, the world's first self-driving car based taxi company, launched in Singapore. In early 2017, Singapore launched an autonomous shuttle bus service in the country.

**E.** China has also made great strides in the field of self-driving cars. "Apolon" is the world's first L4 class self-driving bus to enter the mass production stage, developed jointly by Baidu and Jinlong buses, it has been in trial operation in Beijing, Xiongan, Shenzhen, Pingtan County, Wuhan and Tokyo, Japan since 2018. That same year, Huawei and Audi signed a strategic partnership, the Memorandum of Understanding, to promote technology synergies in the information, communications and automotive industries, and is expected to launch a 5G self-driving car by 2020.

### **(3) the status of legislation on self-driving vehicles.**

Self-driving vehicles, with the help of the autonomous learning ability of artificial intelligence, are able to autonomously collect real-time information about the environment around the vehicle without the direct intervention of the driver, at the same time, evaluate the important variables, make effective decisions, and finally complete the driving task. Because artificial intelligence has the ability of self-decision-making, it is impossible to draw reasonable conclusions according to the current tort law system when the self-driving car has a traffic accident. Legislation needs to take into account the challenges that autonomous driving technology poses to existing legal norms, as new technologies will break through or subvert traditional driving technologies that require drivers to operate conventional vehicles, cars are also designed, built and operated according to human driving settings. While in the state of automatic driving, the driver only takes over the vehicle when needed, and no longer has a driver at a height or in fully automatic driving mode, then the determination of the "Robot driver" and the determination of legal liability, etc., the research of the problem becomes the indispensable part of the system guarantee. The change of driving pattern is prompting the renewal of legislative pattern.

## **II. ANALYSIS AND THINKING**

### **2. Self-Driving Automobiles Challenge to Current Tort Law**

- (1) Driverless Breaks the Traditional Pattern of Liability That Governs Drivers' Behaviors;**
- (2) The claim of "technical neutrality" contradicts the basis of the victim's right to claim compensation;**
- (3) Deep learning algorithm hinders the identification of defects in current product liability.**

**(1) Driverless driving has broken through the traditional imputation mode, in which the driver's behavior is the object of regulation.**

The current law is based on the operating principle of the traditional automobile, a set of code of conduct that natural person should obey in driving process is constructed. But there is a fundamental difference in the operating principle between self-driving cars and traditional cars. The original intention of their research and development is to gradually liberate people's limbs. In this sense, the development course of self-driving vehicle is the course that the main body of driving duty changes from natural person driver to self-driving system. When the car is in auto-driving mode, the auto-driving system takes on most of the driving tasks and controls the driving power. At this time, if natural human drivers are required to maintain the same standard of duty of care as traditional cars, not only is it a complete departure from the original intent of self-driving cars, but it violates the rule of law that rights and obligations are compatible. Depending on the analysis and calculation of big data, the automatic driving system can independently choose the driving route and speed to complete the driving task, and with the continuous upgrading of automatic driving technology, the role of human beings in the field of road traffic has gradually changed from driver to passenger, the standard of the rights and obligations that the natural driver should follow in the traditional road traffic responsibility is no longer applicable to the traffic accidents caused by self-driving cars. The ultimate realization of driverless goal means that the road traffic responsibility system, which takes the motor vehicle as the responsibility subject and the driver's behavior as the regulation object, faces the dilemma of the application of law.

**(2) The claim of "technical neutrality" contradicts the basis of the victim's right to claim compensation.**

Weber put forward the concept of "rationality" and defined the nature of technology as formal rationality characterized by means, process and computability. That is to say, technology itself is only a kind of factual judgment, objectivity-oriented, value-neutral position, and inherently unfettered by subjective emotion and value choice. The "kitchen knife theory" makes this claim very well. Although kitchen knives serve both the functions of cutting vegetables and killing people, the makers of kitchen knives should not be held responsible for killing people by the purchase of kitchen knives. Back to self-driving cars in traffic accidents. According to Weber, artificial intelligence technology represents formal rationality and seems to have nothing to do with value.

From this point of view, although the producers endow the autopilot system with the ability to control the vehicle to a designated destination, the process of using this ability is often autonomous. Once the autopilot system is programmed and inputted, the designer can no longer control the vehicle through data analysis and data input. In the process of driving, it is the user who exerts influence on the vehicle, such as the start and close of the vehicle or the setting of departure and destination. Thus, the designer can invoke the claim of "technical neutrality" to separate his behavior from the wrongfulness of behavior and the causality of tort, and even transfer the tort liability to the user's improper operation, thus defending the basis of the victim's right to claim compensation.

**(3) Deep learning algorithm hinders the identification of defects in current product liability.**

**A. On the one hand, from the point of view of science and technology;**

**B. On the other hand, from the point of view of the cost of proof**

The principle of "Technology neutrality" gives the reason for producers to call for "Technology innocence" in the responsibility of road traffic accidents, but even though technology itself is innocent, from the point of view that the products of carrying technology may infringe the safety of people and property, the tort legal relation of traffic accident of self-driving vehicle can be adjusted in the field of product liability. However, the premise of product liability application is that there are defects in the product. Based on the complexity and specialty of the automatic driving technology, there are many obstacles to judge whether there are defects in the current product liability framework.

**A. On the one hand, from the point of view of science and technology**

Artificial intelligence is a burgeoning field, its development history is only forty to fifty years, there are still many technical problems that have not been solved yet. In particular, the deep learning algorithm that the autopilot system relies on is originally inspired by the neural network operation mechanism of the human brain. Human beings have not yet decipher the detailed mechanism of abstraction, induction and inference of the human brain, and can't do well in the application of deep learning algorithm. Even the designers and builders of autopilot vehicles can't claim to have mastered the operation principle of deep learning algorithm. The existing product liability emphasizes the predictability of producers. But in the case of traffic accidents of autopilot vehicles, the model of deep learning algorithm makes it impossible for the autopilot vehicles to predict their specific actions. From this point of view, because of the complexity of the algorithm embedded in autopilot system, product defects have become "Schrodinger's cat" in legal theory to some extent. In other words, limited by the current level of science and technology, if the existing product liability system is considered, the proposition of defects in autopilot vehicles is often in a state of uncertainty, and its objectivity and authenticity are difficult to be proved.

**B. On the other hand, from the point of view of the cost of proving**

The field of artificial intelligence is characterized by specialization. Even if product defects exist objectively, most of the parties and judges do not have the knowledge and ability in the field of computer science and can not understand accurately the deep learning algorithm on which autopilot system relies. The court proceedings have to be carried out by professionals, which greatly increases the cost of litigation.

Based on the above two considerations, under the current legal framework, it is difficult and uneconomical to prove defects, and it is difficult to meet the premise of the application of product liability. Therefore, it is unrealistic for victims to seek remedies through the current product liability system.

### **III. DISCUSSION**

**3. Major views of academic circles on legal regulation of personal injury caused by artificial intelligence**

**(1) Conferring legal personality on autopilot automobiles;**

**(2) Expanding interpretation of the existing tort law ;**

**(1) Conferring legal personality on autopilot.**

The arguments for this view come down to the following points:

**A.** From "man can not be human" to "man can not be human", especially the establishment of legal subject status of legal person provides a way of thinking to expand the scope of civil subject;

**B.** It makes it possible for autopilot automobiles to assume its own responsibility through the liability fund set up by stakeholders;

**C.** In conferring the automobile liability on autopilot, the embarrassment that is difficult to identify the elements of tort liability will be solved.

**(2) Expanding interpretation of the existing tort law**

**A. Claim owner (user) of tort liability**

**B. Reference to the theory of vicarious responsibility**

**C. Claiming that producers bear tort liability**

**A. Asserting tort liability on the part of the owner (user)**

The implication of this is that the captain is responsible for his ship. In *State v Baker*, the presiding court applied this theory more explicitly. The judge found that when a user of an autopilot vehicle entrusted an autopilot system to "drive" the vehicle, the user had the same responsibility if the system was not competent for the task. For the public safety, the user cannot "entrust" the act of avoiding his obligations imposed by law. In this regard, there are many foreign cases that define users of autopilot vehicles as drivers who shall bear tort liability for traffic accidents.

**B. Reference to the theory of vicarious responsibility**

Some scholars believe that autopilot vehicles follow human instructions and perform a series of driving tasks, just like the drivers employed by humans. If an autopilot violates road traffic safety rules and causes a tort accident, the owner should be held liable, just as the employer should be held liable for the employee's performance of duties. There is a precedent that employers pay employee tax on robots in Switzerland, which reflects the rationality of the theory of vicarious liability: on the one hand, the liability identification is clear and operable; on the other hand, the damage can be compensated in a timely and adequate manner.

**C. Claiming that producers bear tort liability**

When autopilot vehicles reach L4 or L5 grade, it is an indisputable fact that the autopilot system controls the right of control in operation. Autopilot vehicles have the nature of products. Although there are different opinions that the failure that causes traffic accidents is mainly caused by autopilot system, it is debatable whether an autopilot system is a "product", we contend that autopilot vehicles are in whole defective "products". As an autopilot system, as an integral part of durable products, consumers do not have the option to purchase vehicles that do not include autopilot systems. It is not persuasive to try to separate the two so as to deny that autopilot vehicles fall into the category of products. Therefore, some scholars put forward that it is more legitimate for producers to act as the subject of liability than consumers in the recognition of tort liability for autopilot vehicles.

As an advanced technology, autopilot vehicles will go through a tortuous process of growth. While promoting social progress, it may cause some damage. Therefore, it is necessary to strike a balance between rights protection and development promotion. In the early stage of development, it will undoubtedly increase the cost of development of autopilot technology, which is not conducive to technological innovation and social benefits maximization. If the principle of presumption of fault liability is adopted, the tension between costs and benefits can be alleviated to a certain extent. Some scholars think that two questions should be answered to determine the fault of producers: a. Is the victim under the protection of law? Has the victim suffered the type of damage that the law aims to prevent? Once these two points are met, the victim only needs to prove the damage and causality to be presumed that the producer is at fault.

#### **IV. SUGGESTIONS**

4. This article holds that it is relatively reasonable for the producer to bear the tort liability of traffic accident.

(1) According to Hand's formula, the premise of assuming liability for damages is that the producers of the prevention cost have the core technology of artificial intelligence, which is less than the product of the accident possibility and the damage, all the functions of self-driving cars are generated by algorithmic programs composed of codes written by producers, and as the subjects most familiar with the operating principles of self-driving cars, producers have the lowest cost of prevention by improving technology and reducing the likelihood of accidents. Compared to the high-tech know nothing about the consumer, as the producers of self-driving cars as the first person responsible for traffic accidents more appropriate.

(2) In accordance with the principle of risk-benefit alignment, consumers have paid a high consideration in exchange for exemption from driving obligations, while the producers of self-driving cars have obtained a large amount of profits from it and should bear the corresponding risks.

(3) The assumption of tort liability will form a restraint mechanism, and the pressure of huge compensation can force producers to improve product quality and provide higher performance products for the public, which is beneficial to the maximization of social benefits.

(4) Extricating consumers from tort liability will help stimulate the consumption of self-driving cars and promote the development of the industry.

(5) The allocation of tort liability for traffic accidents caused by self-driving vehicles is actually a game between producers and consumers. The producers are in a superior position in market transactions and have a

strong ability to compensate, and the loss can be allocated to each consumer through cost accounting, at the same time, as the technology continues to mature, the probability of traffic accidents continue to reduce, the producer's overall responsibility costs will also decline year by year. Producers, as responsible parties, are more likely to achieve win-win outcomes than individual consumers, who alone bear huge claims.

## V. CONCLUSION

It is still too early for humans to talk about the awakening of machines. At the dawn of AI, the big question for the law should be how to distribute the benefits and damages of AI in its interactions with humans. Autopilot has the ability of autonomous learning and autonomous decision making by virtue of artificial intelligence. When traffic accidents happen, the existing tort law liability system can not solve the new problems in practice. At present, the independence of artificial intelligence can not reach the standard of liability subject in legal sense, so the tort liability of autopilot automobile traffic accident is mainly adjusted by product liability.

On the one hand, establishing a legal model of no-fault liability principle, low standard of reasonable expectation of consumers and presumption of causation can meet the challenge of "technology-neutral" and "deep learning algorithm" to a certain extent.

On the other hand, in the auxiliary driving phase, there is a need to conduct separate argumentation on the road traffic liability and the product liability. Products may be determined as defective if manufacturers fail to comply with the obligation to warn of and explain reasonable dangers. The key to solve the problem of "takeover" lies in whether the natural person driver completely gives up his driving vigilance when the autopilot system makes a request or not. Under special circumstances, such as the victim is at fault, the owner and the user are separated, the third party is at fault and the liability is fair, the identification and allocation of tort liability for autopilot automobile traffic accidents are identical as well as different from those of traditional automobiles. The main difference lies in the fact that the producer has replaced the driver as the main liability subject of traffic accident.

Finally, there is still great room for improvement in safety and performance standards, "black box" system, compulsory insurance system and compensation fund system. In traffic accidents involving self-driving cars, The change in the nature of tort liability from road traffic liability to product liability will inevitably put forward new requirements for the current auto insurance model: a. Damage caused by defects of autopilot automobiles shall be included in the scope of auto traffic accident insurance; b. Persons inside autopilot automobiles who suffer damages in traffic accidents are also entitled to compensation; and c. Victims of traffic accidents can obtain insurance compensation in a convenient and timely manner.

On the other hand, a compensation fund system shall be established. In fact, the compensation fund system for traffic accidents of autopilot automobiles is not very different from that of traditional automobiles. However, the sources of relief funds can be further expanded, for example, manufacturers withdraw a certain percentage of their auto insurance premiums and the taxes paid by the manufacturers. Science and technology change the future, although legal development should try to keep pace with social development, in order to better play the role of citation and coercion, but the discussion on the auto traffic accident tort liability can not bypass the current technical development fence. At present, the technology of self-driving cars is developing by leaps and bounds. It is not practical to solve the problem of traffic accident tort by means of special legislation. Legislators shall, according to the characteristics of self-driving automobiles which distinguish them from traditional automobiles, expand the interpretation of existing legal norms to adapt to new situations in practice. Although the current tort law for autopilot car run-in and acceptance still need time, but the theory and practice are working for this goal, we wait to see the development of autopilot car, whether technical or legal aspects.

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