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Criminal Liability Subjects in Autonomous Vehicle Accidents and Research on the Duty of Care

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Abstract. The rapid advancement of autonomous driving technology, while enhancing travel efficiency and safety, has sparked significant debate regarding the identification of criminal liability subjects. Based on an analysis of China's legislative landscape and international practices, this paper focuses on the criminal law challenges in attributing liability in accidents involving autonomous vehicles. Since autonomous driving systems themselves do not qualify as criminal subjects, liability should primarily fall on manufacturers and users, but only in cases involving intent or gross negligence. In terms of normative foundations, this paper integrates the "theory of permitted risk" and the "theory of conflicting obligations," arguing for a certain degree of risk tolerance in the development of autonomous driving technology. In situations involving conflicting legal interests, priority should be given to protecting passenger safety. Furthermore, from the perspectives of manufacturers and users, the paper outlines specific duties of care, including compliance in production, risk disclosure, and ongoing monitoring obligations for manufacturers, as well as users' obligations for preemptive prudence and post-accident assistance. Ultimately, it is proposed that criminal law should reasonably narrow the scope of liable parties and clarify special duties of care, thereby safeguarding individual legal interests while providing institutional support for the regulated development of autonomous driving technology.

Keywords: autonomous vehicles, criminal liability subject, permitted risk, conflicting obligations, duty of care.

1. Introduction

At the beginning of the 20th century, with the birth of motor vehicles, the world witnessed a revolution in the automotive industry. More than a century later, humanity now stands on the threshold of another industrial revolution, facing the transformation from traditional driving modes to autonomous driving modes. This technology heralds a future where vehicles can operate normally without human brain intervention, and even reduce the incidence of accidents while maximizing efficiency. However, under ideal circumstances, accidents caused by autonomous driving still occur, and issues such as the attribution of criminal liability and whether the current criminal law can adapt to the paradigm shift in human driving methods have gradually emerged. When autonomous driving systems rely on algorithms and sensors, the issue of liability attribution becomes increasingly complex. Should the responsibility fall on the manufacturers of autonomous vehicles, software

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developers, or the users who choose to trust this technology? Traditional criminal law emphasizes individual behavioral responsibility, but autonomous driving systems break through the concept of tools and have independent decision-making functions, which makes the application of the basic elements of criminal liability (actus reus, i.e., illegal acts) and subjective elements (mens rea, i.e., intent or culpable mental state of a crime) core elements of criminal law an urgent new issue to be resolved [1]. These issues not only touch the boundaries of traditional criminal law theory but also pose unprecedented challenges to the existing legal liability system.

2. Concept and legislative status quo of autonomous vehicles

2.1. Concept and technical classification

In 2021, the Ministry of Industry and Information Technology issued the new Administrative Specifications for Road Testing and Demonstration Application of Intelligent Connected Vehicles (for Trial Implementation), which clearly defines the concept of autonomous vehicles: intelligent connected vehicles, also known as smart cars or autonomous vehicles, integrate cutting-edge sensor technology, high-performance controllers, and complex algorithm systems, and realize in-depth interaction with the surrounding environment through the in-depth integration of modern communication technology. On August 20, 2021, the State Administration for Market Regulation and the Standardization Administration of China issued the Classification of Automobile Driving Automation, which classifies autonomous vehicles into 5 levels from L0 to L5 according to their intelligence levels. Level L5: fully autonomous driving, where the vehicle can independently complete all driving tasks under any circumstances without any intervention from the driver [2]. It can be seen from the above that vehicles with L1 and L2 intelligence only have auxiliary functions for natural person drivers to control, and are actually driver-operated vehicles. Technically, they do not belong to autonomous driving and should not be discussed as "autonomous vehicles" with intelligent control capabilities [3]. Based on this, this paper selects autonomous vehicles above L3 level as the object of analysis and discussion.

2.2. Policy and legislative status quo

In recent years, China has attached great importance to the research and development of autonomous vehicles and issued a series of relevant documents. These include: Made in China 2025 released in 2015, which outlines the development blueprint of China's autonomous vehicles and requires the completion of the transformation and upgrading of the automotive industry by 2025; [4] in July 2017, the State Council issued the New Generation Artificial Intelligence Development Plan, which mentions strengthening the supporting development capacity of autonomous driving technology, fully developing intelligent traffic perception technology, forming China's independent autonomous driving technology system as soon as possible, and developing relevant road safety management regulations to keep up with the development of new fields; [5] the Guidelines for the Construction of National Industrial Standard System for Internet of Vehicles (Intelligent Transportation-related) issued in 2021 proposes to form a standard system that can support the application of the Internet of Vehicles and meet the needs of transportation management and services by 2025 [6].

It can be seen that China has made rapid progress in technical and industrial policies, but there is a lack of matching institutional responses at the criminal law level. The tension between this legislative lag and technological advancement is the institutional background for discussing the issue of criminal liability attribution in this paper. This includes but is not limited to legal provisions

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on liability attribution, product safety liability, ethical considerations, etc., when autonomous vehicles cause traffic accidents.

3. Priority of protection in autonomous vehicle accidents

3.1. Debates on the view of protection priority

The rapid development of autonomous driving technology, while bringing unprecedented convenience and safety potential to travel, has also pushed a series of complex ethical and legal issues into the public eye. One of the most intractable is how to make optimal decisions when the interests of multiple people are threatened in the event of vehicle failure or unavoidable accidents, a dilemma vividly known as the "trolley problem" in the field of autonomous driving.

Regarding the "trolley problem" dilemma of autonomous driving, there are three representative viewpoints in academic circles:

First, the utilitarian perspective, which specifically includes: taking unfavorable measures against road participants who violate traffic rules, that is, when an accident is caused by a road user's illegal behavior, the system should minimize protection for the illegal user; at the same time, the priority of protection for other road traffic participants with illegal behaviors should also be reduced accordingly. On this basis, priority should also be given to protecting the safety of passengers inside the autonomous vehicle [7]. However, this way of quantifying life ignores the irreplaceability of individual life and is likely to conflict with the concept of respecting human rights in modern rule of law societies.

Second, the theory of equal right to life. At present, in terms of protection priority, the prevailing view generally holds that the right to life should be protected in the first place, and should not be measured simply by quantity. Therefore, both in autonomous driving and any issues involving the protection of the legal interest of life, we should actively avoid the solution of quantifiable life, but respect each individual, safeguard their dignity and value, and strive to find the maximum balance.

Third, randomism. This theory argues that because the value of life cannot be accurately measured, and there is no perfect solution to life protection when danger occurs, and there is a subjective judgment standard of "reasonable person" which is full of random events, the priority of protection should be determined according to the principle of randomness [8]. However, simply handing over the decision-making power of life safety protection to a seemingly advanced but opaque random algorithm will increase the anxiety and worry of consumers of autonomous vehicles, and also have a negative impact on the sharing of responsibility after the accident.

3.2. The author’s view—priority should be given to protecting passengers' safety

3.2.1. Inevitability of market logic

From the perspective of a general "reasonable person", no one would want to buy a new type of car that abandons the life rights and interests of the user to protect the interests of the car itself or other traffic participants when making decisions in the event of a safety accident. This design logic fundamentally violates the respect and cherishment of the value of life in human nature, and also violates the basic principle that scientific and technological progress should serve human well-being. In reality, multiple autonomous driving accidents have verified this social expectation. For example, the 2018 Uber autonomous vehicle fatal crash: an Uber autonomous vehicle struck and killed a pedestrian. This criminal case focused on the human safety driver and triggered discussions on the

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attribution of liability for the autonomous driving system. The case highlighted the complexity of liability attribution when humans interact with artificial intelligence [9]. Multiple accidents involving Tesla's Autopilot system have aroused public doubts about whether the vehicle prioritizes passenger protection [10]. After the NOA assisted driving accident of Xiaomi SU7 on the Anhui expressway section in 2025, public opinion also paid close attention to whether the vehicle's decision-making put passenger safety first. These cases show that when facing autonomous driving risks, consumers are most concerned about whether their own lives can be protected with priority.

3.2.2. Special protective obligations in law

At the jurisprudential level, according to the "harm principle", everyone, while enjoying freedom, assumes the basic obligation of not infringing upon the legitimate rights and interests of others, that is, individual behavior cannot cause substantial harm to others [11]. Referring to foreign experience, the United Kingdom has enacted the Automated and Electric Vehicles Act (AEVA). The Act defines an autonomous vehicle as a motor vehicle that can drive independently and safely without human monitoring. According to the provisions of AEVA, as long as an autonomous vehicle is in autonomous operation, its insurance company must assume liability for compensation and pay for damages to others or property caused by the vehicle [12]. Germany has amended the Road Traffic Act (StVG) to allow the use of highly or fully automated driving functions. Such systems are described as being able to take over driving tasks within a specific operating area, but the driver can turn off the system at any time. According to the provisions of StVG, the driver is still liable for any damage caused by the vehicle unless they can prove that they are not at fault.

According to the provisions of StVG, if the damage is caused by the design defects of the autonomous driving system itself, the automobile manufacturer or the system manufacturer is generally liable for compensation up to 10 million euros. In addition, if there is a driver in the autonomous vehicle, the driver must maintain a certain duty of care: the driver must generally comply with all driving instructions issued by the autonomous driving system; and when problems occur in vehicle driving, the driver needs to be ready to take over vehicle driving and control at any time. The vehicle must be equipped with a data logger to record when the autonomous driving function is turned on or off, as well as all faults and accidents that occur during the operation of the vehicle [13].

Therefore, in addition to the general obligation of commodity quality, manufacturers have a safety protection obligation arising from the sales contract to purchasers of autonomous vehicles, and need to prioritize protecting passenger safety. This special protective obligation makes it a logical necessity to tend to prioritize protecting passengers' safety when weighing between passengers' safety and passers-by's rights and interests.

4. Negation of the criminal subject status of autonomous vehicles

As a pioneer in the autonomous vehicle industry, the United States, taking California as an example, has a policy that focuses on strengthening manufacturers' liability. This approach stems from a basic recognition: autonomous vehicles can operate normally without human intervention in most cases, so enterprises must assume corresponding responsibilities when technical failures occur. However, it should be specially noted that some autonomous driving models may still be intervened by drivers. If an accident is caused by the driver's operation, the liability will return to the traditional legal framework. We should not only recognize the achievements of scientific and technological progress but also ensure that drivers are responsible for their behaviors [14].

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Affirmativists actively advocate endowing strong artificial intelligence with the status of criminal liability subjects. This proposition aims to reconstruct the existing penalty system by introducing new penalty methods, such as deleting data, modifying programs, and permanent destruction [15]. This view holds that endowing strong artificial intelligence with the status of criminal liability subjects is both reasonable and conducive to the exertion of the functions of criminal law. Intelligent robots can completely be regarded as criminal liability subjects because they have strong identification and control capabilities. This change will only affect the redistribution or separation of criminal liability, and will not lead to the shirking of criminal liability by one party; on the contrary, it will help build a more fair and reasonable legal framework [16]. The mainstream view holds that through deep learning and logical analysis, strong artificial intelligence, like human general thinking, fully has the ability to transcend the programs designed and compiled by humans under the domination of free will, and can realize the cognitive and control capabilities required by criminal law [17]. Imposing penalties on it is meaningful and fully in line with the purpose of punishment, provided that the artificial intelligence subject has sufficient rational ability [18]. The author believes that acknowledging that autonomous driving systems or strong artificial intelligence have independent consciousness like humans is undoubtedly a major challenge to the dialectical materialism of Marxist philosophy. Although artificial intelligence shows amazing intelligence and learning ability in some aspects, it still lacks the subjective initiative and creativity unique to human consciousness.

4.1. Lack of independent consciousness

The foundation for the establishment of social orders such as morality and law is that humans have personality, truly become beings-for-themselves, set goals for themselves, restrain their behaviors, and independently determine their relationship with existence through practical reason [19]. This practical reason is the key that distinguishes humans from other creatures, reflecting the freedom and autonomy of humans in will. This free will is the essential feature that distinguishes humans from the animal kingdom and makes them a unique species. However, when we examine autonomous driving, a powerful artificial intelligence technology, we find that its operating mechanism is essentially different from the decision-making process of humans based on free will. Although autonomous driving systems can quickly collect and process road information, make driving decisions, and accurately control vehicles, all these complex behaviors are based on the careful design and planning of program designers in advance.

In the "trolley problem" dilemma, an autonomous vehicle can only choose a preset plan and cannot make decisions based on its own values and moral sense. An autonomous vehicle cannot be defined as having a "behavior" at the level of factual attribution; its "decision" and execution of the minimum risk strategy are only a link in the causal chain determined by the program [20]. Autonomous vehicles lack substantial independent consciousness and the ability of moral judgment, and cannot become subjects of criminal liability. Therefore, in a substantive sense, autonomous vehicles do not have independent consciousness and cannot be responsible for their behaviors like humans. Based on this understanding, we cannot regard autonomous vehicles as criminal liability subjects.

4.2. Lack of criminal responsibility capacity

Criminal responsibility capacity refers to the actor's ability to recognize and control their own behaviors. The mental state of the actor when implementing the act is one of the criteria for

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determining criminal responsibility capacity, and this state also determines whether the party assumes criminal responsibility. Only when the actor can clearly recognize the nature and consequences of their behavior and have a clear understanding of the law can criminal law convict and punish them based on their subjective fault and objective behavior. Conversely, the lack of any factor will lead to a violation of the principle of fairness and justice. There are two crucial decisive factors for the determination of criminal responsibility capacity: one is the actor's physiological age; the other is the actor's mental state. These two factors together form the cornerstone for evaluating the actor's criminal responsibility capacity [21].

4.3. Failure to achieve the purpose of criminal punishment

If we decide to punish an autonomous vehicle, we are essentially dealing with an object, and it is difficult to achieve the purpose of special prevention and general prevention that criminal punishment has always pursued. According to Bentham's principle of proportionality between crime and punishment, punishment can only truly demonstrate its value when the pain it brings to the actor far exceeds the benefits the crime brings to them. The core of this theory is that punishment must be severe enough to become a strong deterrent for the actor to choose to give up committing a crime after weighing the pros and cons [22]. However, as a non-living entity without independent consciousness, an autonomous vehicle operates entirely based on pre-set programs and algorithms. This means that no matter what form of "punishment" we impose on an autonomous vehicle, it cannot feel any pain or fear, so it is impossible to achieve the purpose of preventing crimes according to Bentham's principle of proportionality between crime and punishment.

Criminal acts involving autonomous vehicles are often caused by objective reasons, namely program errors, design defects, or the randomness of the external environment. Punishing a vehicle equipped with an autonomous driving system will be meaningless because such crimes do not originate from subjective malice. In this case, traditional penalty methods are powerless because they cannot touch the core of the problem: autonomous vehicles themselves do not have the ability of moral judgment and self-restraint. Therefore, we cannot reduce the incidence of accidents caused by autonomous vehicles through criminal punishment.

4.4. Inapplicability of penalty methods directly

Unlike traditional vehicles controlled independently by humans, it is illogical to attribute liability or impose criminal penalties on autonomous vehicles from a traditional legal perspective after traffic accidents occur. If we forcibly equate products designed with artificial intelligence with legal persons, the punishment measures in the current criminal law designed based on human psychology and social behaviors will completely lose their due deterrent and corrective functions for artificial intelligence lacking subjective initiative and moral responsibility, thus becoming ineffective. This means that to truly incorporate artificial intelligence into the criminal legal framework, it is necessary to build a completely new penalty system from scratch according to its particularities. This is not only a task with huge workload and complex technology but also may consume a lot of scarce criminal law resources, leading to unreasonable resource allocation.

To sum up, conflicting obligations are particularly prominent in the "trolley problem" of autonomous vehicles. In this case, the behavior of autonomous vehicles choosing to protect passengers' lives and safety not only complies with the requirements of the principle of conflicting obligations but also reflects the respect and protection of the legal interest of passengers' lives.

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5. Duties of care of various subjects of autonomous vehicles

5.1. Duties of care of automobile manufacturers

As discussed earlier, because autonomous driving systems lack human consciousness, emotions, and moral judgment capabilities, autonomous driving systems themselves cannot bear criminal liability. Therefore, when an autonomous vehicle accident occurs, the first focus should be on the manufacturers of autonomous vehicles. Some scholars believe that it is unreasonable for manufacturers to still bear criminal liability if they negligently design or produce defective autonomous driving systems. Because if manufacturers assume excessively high duties of care, it may lead to the loss of their motivation for innovation. Autonomous driving technology is a highly complex and constantly developing field, and manufacturers need to continuously try and innovate in the research and development and manufacturing process to improve the performance and safety of the technology. If the requirements for manufacturers are too high, they may become overly conservative when facing potential legal risks, thereby hindering technological progress [23].

However, if producers have no responsibility at all, it is difficult to ensure that they earnestly perform their due obligations in the corresponding links of research and development and manufacturing. The author believes that the duties of care of manufacturers are mainly reflected in the production and manufacturing process before the accident occurs. Specifically, manufacturers should fulfill the following obligations: first, the obligation of compliant production, that is, the produced automobiles must meet national standards and industry standards. This means that when designing and manufacturing autonomous vehicles, manufacturers must strictly follow relevant technical specifications and safety standards to ensure the quality and safety of products. Second, the obligation of risk disclosure. When the autonomous driving system issues dangerous instructions or warnings, manufacturers should provide clear instructions and warnings to users. This means that when designing the system, manufacturers should consider various possible dangerous situations and set up corresponding warning mechanisms in the system. Third, the obligation of continuous monitoring. Manufacturers should continuously follow up the usage status of autonomous vehicles, which means that after the product is put on the market, manufacturers still need to monitor and analyze the usage of the product, and timely discover and solve potential problems. When necessary, manufacturers should also recall defective products in a timely manner [24].

5.2. Duties of care of automobile users

Before using an autonomous vehicle, the user must conduct a routine inspection of the vehicle's safety performance. If problems are found during the inspection but the vehicle is still used, resulting in a traffic accident, the user shall bear corresponding responsibilities for the accident. In addition, users must also ensure their driving qualifications and status when using autonomous vehicles. This means that users must hold a valid driving license and have corresponding driving skills and experience. At the same time, users must ensure that their mental state is normal, and shall not drive under the influence of alcohol or drugs, nor use autonomous vehicles when fatigued [25].

After an accident occurs, the user should actively rescue the victims. In accordance with the provisions of Article 70 of the Road Traffic Safety Law of the People's Republic of China and the Interpretation on Several Issues Concerning the Application of Law in the Handling of Criminal Cases Involving Endangering Production Safety, the driver shall act as a "manager" in traffic accidents and has a legal obligation to report the accident. The obligations imposed on drivers by Article 70 of the Road Traffic Safety Law of the People's Republic of China include both "reporting

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to the on-duty traffic police or the public security organ's traffic management department" and "immediately rescuing the injured" [26]. Users of automobiles must ensure that the automobile does not endanger others during use to control the source of danger that is the automobile. If a user causes harm to others by using an autonomous vehicle, they have the obligation to rescue the victim.

6. Conclusion

In the "trolley problem" dilemma, the priority of protection for autonomous vehicles has become the focus of debate. This paper holds that prioritizing the protection of passengers' safety is an inevitable choice in the design of autonomous vehicles, as well as a respect for consumers' rights and interests and a compliance with market demand. In terms of criminal liability subjects, this paper clearly points out that autonomous vehicles should not be regarded as independent criminal liability subjects. Autonomous vehicles lack independent consciousness and criminal responsibility capacity, punishing autonomous vehicles cannot achieve the purpose of criminal punishment, and it is difficult to determine the penalty methods. Moreover, manufacturers and users of autonomous vehicles should only bear criminal liability under specific circumstances. Finally, this paper discusses the duties of care of manufacturers and users of autonomous vehicles, including manufacturers' obligations of design, manufacturing, instruction, warning and monitoring, as well as users' obligations of pre-accident vehicle condition inspection and post-accident rescue of victims.

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