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Research on the Criminal Law Regulation of Crimes Caused by Out-of-Control Intelligent Robot Programs

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Abstract

This article explores the legal regulation of the crime caused by out-of-control intelligent robot programs. The author has proposed **criminal regulation** in various aspects such as program design, testing and certification, users and regulators. In the program design stage, suggestions were put forward to accurately determine the relationship between harmful behavior, criminal behavior, and implementation behavior. In the program testing and certification stage, it is advocated to use the conditional theory and objective attribution theory to determine responsibility, in order to distinguish the behavior bearers in the crime of losing control of intelligent robot programs. For users and regulators, it is recommended to strengthen the regulation of foresight obligations for the crime of losing control of intelligent robot programs, in order to reduce the risk of illegal activities caused by program failures.

Keywords: criminal law, robot, artificial intelligence, law regulation, subject of crime

1. Introduction

The criminal law risks stemming from out-of-control intelligent robot programs present unprecedented challenges and impacts to the current criminal law system and theory. This is particularly evident in the blurred delineation of criminal law responsibility subjects, the complexity of causal relationships leading to difficulties in criminal law determinations, challenges in ascertaining the objective culpability of behaviors, and complexities in determining subjective culpability (Sharkey N, et. al., 2010; Pagallo U., 2011).

1.1 Types of Intelligent Robot Crimes

Intelligent robot crimes exhibit characteristics of complexity and variability and can generally be classified into three basic types: Firstly, crimes triggered by the out-of-control or sudden malfunctions of intelligent robot programs. Secondly, crimes committed by natural persons using intelligent robots. Thirdly, crimes perpetrated by intelligent robots under external malicious interference or manipulation, such as hacker crimes or injection of malicious programs.

1.2 Criminal Cases Involving Out-of-Control Intelligent Robot Programs

In February 2015, the UK witnessed its first heart valve repair surgery using the da Vinci surgical robot. However, the da Vinci surgical robot malfunctioned, causing not only misplacement of the patient's heart sutures but also puncturing the patient's aorta, resulting in the patient's death a week after the surgery, ending in failure.

In July 2015, Wanda Holbrook, an assembly worker at an American automobile factory, was "killed" by an out-of-control robot, marking the "world's first robot homicide case" that garnered significant attention.

During the 18th China International High-Tech Fair in 2016, a robot named "Xiao Pang" suddenly lost control to damage booths and injure bystanders.

In March 2018, Huang tragically lost his life after his Autopilot-enabled Model X collided with a safety barrier on U.S. Highway 101 in Mountain View, California.

Tesla's workplace injury report submitted to local regulators in 2021 detailed an incident where an engineer, while programming two malfunctioning robots, was unexpectedly attacked by one of the robots designed to handle car parts. The robot extended its metal claws towards the engineer's back and arms, leaving a "bloodstain" on the factory floor.

In November 2023, at an agricultural distribution center in South Korea, which implemented intelligent office systems, a robot maintenance worker was mistakenly identified as a box by a processing robot. The processing robot grabbed the maintenance worker with its robotic arm and threw him onto the conveyor belt, resulting in his death.

These cases underscore the real threat posed by crimes resulting from out-of-control intelligent robot programs, highlighting the deficiencies in existing technology to ensure the safe operation of robots. It is imperative to enhance supervision and regulation of the design, testing, and maintenance of intelligent robot programs to ensure that they can serve human society safely and reliably, without becoming tools or threats to criminal activity.

1.3 The Root Causes of Crimes Caused by Out-of-Control Intelligent Robot Programs

There are three scenarios: the design stage, testing certification stage, and usage stage of intelligent robot programs. In the design stage, designers are constrained by their knowledge reserves, relevant theoretical research, and the limitations of existing R&D equipment and manufacturing materials, making it difficult to comprehensively and accurately predict the potential occurrences during the use of intelligent robots. During the testing and certification stage, test engineers may overlook or inadequately assess the quality and completeness of program testing and certification, leading to criminal incidents. In the usage stage, if critical components age or become damaged without timely detection, repair, or update, or if environmental changes exceed the robot's design capabilities, the intelligent robot may experience program failures during operation (Gogarty B. & Hagger M., 2008).

Criminal behavior resulting from out-of-control intelligent robot programs or sudden malfunctions exhibits highly specific characteristics. These include:

1) Demonstrating a certain level of autonomy, stemming from their intelligent learning capabilities, and making independent decisions. Consequently, when correcting and improving the program, unscientific decisions may be made, leading to unforeseen incidents and harm to the environment and personnel, resulting in hazardous consequences.

2) Based on the imitation of human thought processes, there may be inadequate judgment of real-time and on-site conditions during usage, resulting in unexpected behaviors.

3) Intelligent robots may exhibit behaviors that designers, testers, and users cannot anticipate.

These characteristics render the criminal behavior caused by out-of-control intelligent robot programs or sudden malfunctions complex and varied, necessitating higher requirements for regulation and prevention.

2. Analysis of Criminal Law Risks Associated with Out-of-Control Crimes Committed by Intelligent Robot Programs

2.1 Blurred Boundaries of Criminal Liability Subjects for Crimes Involving Out-of-Control Intelligent Robot Programs

The development of intelligent robots aims to participate in or replace human labor (Gless S, et. al., 2010; Joh E E., 2016). However, once they stray from control and become criminal subjects, the scientific identification of responsible parties under criminal law becomes exceedingly difficult. Take the case of a surgical robot accident, for instance; the automatic surgical system may fail to accurately identify danger, resulting in deviations in surgical procedures and ultimately causing accidents. In such scenarios, determining the subjects responsible for criminal liability poses significant challenges. If the surgical robot is deemed responsible for causing the accident, the criminal liability of the program's designers and certifiers would be absolved. Simultaneously, the attending surgeon would no longer be considered the agent of action, as the surgical robot remains under program control. However, the attending physician's excessive reliance on surgical robotic technology, shielded from criminal liability, further exacerbates the occurrence rate of surgical safety incidents.

Therefore, identifying criminal liability for intelligent robots necessitates a departure from theoretical concepts, clarifying subject identities, and translating them into criminal law terminologies applicable in judicial practice. Intelligent robots possess the capacity to control and discern their own behaviors. If their autonomous actions endanger their own interests, grounded on criminal law's mandate to protect the rights and interests of vulnerable

groups, intelligent robots may be construed as criminal subjects. However, this contradicts the prevailing criminal law system, which designates natural persons or entities as crime subjects, thereby complicating the identification of responsible parties. Failure to distinctly identify responsible parties precludes assigning culpability. In the context of surgical robot safety incidents, ascertaining subjective culpability also presents challenges. Distinguishing between the attending physician's subjective negligence and behaviors resulting from system failures necessitates a scientific assessment of whether the attending physician foresaw potential issues and consequences of automated surgical modes and whether they excessively relied on automated surgical technology.

The academic community currently harbors divergent perspectives and solutions to this issue, lacking consensus, thereby posing challenges and risks to the application of criminal law. Some scholars argue that intelligent robots' behaviors surpass design boundaries and escape human control, resembling criminal acts borne out of independent will. Consequently, designers, testers, and users evade corresponding responsibilities. However, intelligent robots' autonomous learning abilities render their behaviors potentially originating from both program design and testing/certification or autonomous decisions following loss of control, thus lacking genuine volition and remaining non-criminally liable. The criminal law treatment of crimes involving out-of-control intelligent robot programs may necessitate grounding in negligence theory, thereby mandating program designers, testers, and users to bear commensurate responsibilities.

2.2 Difficulties in Criminal Law Identification Caused by the Complex Causal Relationships of Crimes Resulting from Out-of-Control Intelligent Robot Programs

The causal relationships associated with crimes arising from out-of-control intelligent robot programs are exceedingly intricate, posing significant challenges to criminal law determinations. For instance, during the actual operation of intelligent robots, depending on the application scenario, designers, testing and certification personnel, and users may autonomously customize and optimize the control program they deem reasonable without proper authorization, leading to detrimental outcomes. Consequently, establishing causation in these crimes becomes obscured.

Firstly, in certain scenarios, multiple factors may coalesce, contributing jointly to adverse consequences, rendering it arduous to discern whether the issue stems from the operational error of the intelligent robot or from the inappropriate conduct of the designer, validator, or operator. Secondly, even if it can be demonstrated that harm resulted from specific actions of the designer or operator, it is often challenging to specify which regulation was violated, and establishing a direct link between this violation and the victim's loss proves even more daunting. Moreover, if designers and testers advocate the principle of technological neutrality, legal decisions must exercise greater caution, necessitating thorough evaluation of the validity of this assertion to determine whether designers and testers should be absolved of criminal liability.

Furthermore, if an intelligent robot program exhibits unforeseeable behavior due to internal defects, resulting in erroneous consequences, judicial investigations typically encounter challenges regarding the lack of evidence at the accident's origin and the difficulty in determining whether the system's autonomous decision-making precipitated the accident. This uncertainty in establishing causality significantly compounds the complexity of attributing legal liability and poses a considerable challenge to judicial practice.

2.3 Challenges in Determining the Objective Criminal Behavior of Out-of-Control Intelligent Robot Programs

Identifying the criminal behavior of intelligent robot programs in an out-of-control state has emerged as a new legal issue, challenging the traditional legal principle of "no action, no crime", which asserts that crimes must be based on actual human actions. However, when it comes to robots, the determination of whether their behavior meets the requirements for conduct under criminal law becomes blurred.

Firstly, illegal incidents resulting from the out-of-control behavior of intelligent robots do not always fully align with the requirements of traditional criminal law for constituting criminal behavior. Particularly in some cases, such as when malware triggers an attack without the developer's awareness, attributing legal responsibility directly to a specific individual becomes exceedingly complex.

Secondly, although the behavior of intelligent robots when their programs are out of control appears to be detached from direct human control, their operating logic and action patterns remain deeply embedded within the preset programming rules and decision-making frameworks established by humans. Therefore, conducting objective attribution analysis for criminal acts committed by out-of-control intelligent robots is a crucial step, as it pertains to accurately identifying responsible parties and determining their liabilities within the criminal law system.

Moreover, considering that the extent and impact of crimes committed by out-of-control intelligent robot programs may surpass those committed by natural persons, we should adopt relatively lenient standards when assessing their harmfulness. However, this does not imply a decrease in vigilance against such behavior. On the

contrary, we should broaden the scope of identifying the criminal harm caused by out-of-control robot programs and enforce stricter regulations to prevent the occurrence of such behavior, thereby reducing the frequency of accidents caused by intelligent robots.

2.4 The Challenge of Determining Subjective Culpability for Crimes Committed by Out-of-Control Intelligent Robot Programs

The criminal behavior resulting from out-of-control intelligent robot programs presents a novel challenge to traditional assessments of subjective guilt. Previous theories of subjective culpability primarily focused on natural persons and were grounded in the concept of free will. These theories posited that only individuals possessing the capacity for independent will could be considered criminal subjects and be subject to the constraints of criminal law. They held that natural persons had the ability to exercise free will and rational judgment, enabling them to make autonomous decisions to pursue pleasure and avoid pain. Consequently, the degree of guilt and the application of corresponding penalties for criminal acts committed by natural persons could be assessed based on the choices made by their free will.

However, the scenario in which intelligent robots lose control and engage in criminal acts clearly transcends this theoretical framework. Robots lack free will; their behavior is entirely governed by pre-programmed instructions and algorithmic logic. Once they lose control, their behavioral choices do not stem from their own volition but from factors such as technical malfunctions, program errors, or external interference. This renders the traditional standard of subjective guilt assessment based on free will strained and inadequate for effectively addressing robot-related crimes.

Moreover, the issue of subjective culpability in crimes involving out-of-control intelligent robot programs is further complicated. Intelligent robots possess deep learning capabilities and can learn from their surroundings and mimic human behavior. If an intelligent robot achieves independent learning and imitation through program control, it can circumvent the influence of natural humans. This has prompted the legal community to take note of the subjective aspects of crimes involving out-of-control intelligent robot programs.

The “free will” exhibited by intelligent robots does not stem from natural human rights but is instead pre-embedded in their programs and settings. While the intelligence level of intelligent robots may surpass or even approach that of natural humans, their actions are guided by programs rather than independent choices based on free will. Therefore, traditional theories of free will fail to fully elucidate the issue of subjective culpability in crimes committed by out-of-control intelligent robot programs.

While the concept of free will remains pivotal in criminal law, it is not applicable to intelligent robots lacking human rationality. The actions of robots are primarily driven by programming and algorithms rather than individual choices. Thus, directly applying the theory of free will to analyze robot behavior is insufficient for addressing the issue of subjective fault when an out-of-control program perpetrates a crime.

Consequently, there is an urgent need for thorough discussion and research on attributing subjective responsibility for crimes committed by out-of-control intelligent robot programs. Existing theories of free will prove inadequate in the face of this new category of crime, compelling the legal community to develop new theoretical perspectives to address the issue of subjective liability for robot behavior (Zhang Xuebo & Wang Hanrui, 2023; Zhou Shangjun & Luo Youcheng, 2022).

3. Regulation of Criminal Law on Crimes Caused by Out-of-Control Intelligent Robot Programs

3.1 Regulation of Criminal Law Related to the Association Between Crimes of Out-of-Control Intelligent Robot Programming and the Natural Person (Entity) Responsible for the Design

From various perspectives, explore the association between crimes caused by out-of-control intelligent robot programming and the natural person (entity) responsible for the program’s design, and analyze the corresponding regulations in criminal law.

Firstly, criminal acts resulting from out-of-control intelligent robot programs often stem from inherent flaws in the program design itself or from improper human intervention. If such intervention directly triggers a criminal incident involving an out-of-control robot program, the intervenor shall be held criminally liable according to the law.

Secondly, when natural persons (or entities) involved in the design of intelligent robot programs face crimes caused by program malfunction, even in the absence of intentional criminal intent, if the malfunction results from negligence or oversight during the design process, leading to criminal consequences, they should also bear criminal responsibility. Therefore, when formulating criminal law norms for such crimes, it is essential to fully consider the mechanism for holding program designers (or entities) accountable for negligence to maintain social order’s stability and harmony.

Furthermore, in cases of crimes involving out-of-control intelligent robot programs, if the natural person (or

entity) responsible for the program's design commits intentional criminal behavior, they should also be subject to stringent criminal law regulations. Specific circumstances include intentionally designing an intelligent robot program to carry out criminal activities, or knowingly allowing the program's existence despite the potential risk of others committing crimes, deliberately choosing not to rectify it, and allowing criminal acts to occur. In such instances, the program designer (or entity) should face severe legal penalties and assume corresponding criminal liability.

Simultaneously, when imposing legal penalties on natural persons (or entities) involved in the crimes of out-of-control intelligent robot programs, their role and influence within the socio-economic system should be fully considered. These entities may include large technology companies or scientific research institutions, which play crucial roles in promoting technological innovation and social development. Therefore, when applying criminal law restrictions to them, it is necessary to balance the maintenance of social order and security while avoiding unnecessary infringement of their legitimate rights and interests. This ensures that legal sanctions not only serve their intended purposes of deterrence and correction but also respect and protect their legitimate rights, interests, and contributions within the bounds of the law.

In summary, there exists a close association between crimes of out-of-control intelligent robot programming and the natural person (entity) responsible for the program's design. The natural person (entity) involved in program design bears significant responsibilities in cases of out-of-control intelligent robot programming crimes. Thus, criminal law regulations must thoroughly consider the negligence and intentional actions of natural persons (entities) in program design, imposing appropriate sanctions and considering their societal status and influence during punishment to achieve fairness and effectiveness in criminal law.

3.2 Criminal Law Regulations Related to the Association Between Crimes of Out-of-Control Intelligent Robot Programming and the Natural Persons (Units) Responsible for Program Testing and Certification

In the development process of intelligent robots, program testing plays a crucial role. The quality and thoroughness of program testing and certification are directly related to the stability and safety of intelligent robots. However, due to the complexity and technical nature of program testing and certification, it often leads to oversights and inadequacies, resulting in crimes due to program out-of-control and malfunction. This section examines the relationship between crimes caused by out-of-control and malfunctioning intelligent robot programs and the natural persons (units) identified through program testing and certification from a criminal law perspective, and explores the criminal responsibility of natural persons (units) identified through program testing and certification in crimes related to intelligent robots, as well as related legal risk management measures.

For the testing and certification of intelligent robot programs, the natural persons (units) involved, such as test engineers, test teams, and testing companies, bear direct responsibility. When an intelligent robot causes a crime due to program out-of-control or malfunction, those responsible for program testing and certification may face varying degrees of criminal liability. Firstly, as test engineers, their duty is to ensure that the testing and certification of intelligent robot programs meet high-quality and comprehensive standards. If it is found that there are significant defects or deficiencies in the testing and certification, indirectly leading to criminal incidents, the test engineer may be held accountable under the law. Secondly, the testing team and testing company, as the overall supervisory and management entities, are obligated to strengthen supervision of the program testing and certification process, ensuring strict compliance with relevant laws, regulations, and safety standards throughout the certification process, effectively preventing criminal behavior resulting from inadequate testing and certification. This implies that they may also face legal repercussions in cases of intelligent robot program-related crimes, especially when their negligence directly contributes to the occurrence of criminal incidents.

Technical preventive measures for crimes resulting from program out-of-control and malfunction during the testing and certification process of intelligent robot programs include:

1) Strengthening quality management in testing and certification: Those responsible for program testing and certification should enhance quality control over the process, actively adopt advanced testing technologies and strategies to ensure comprehensive testing coverage and accurate results, thereby effectively preventing potential risks arising from inadequate testing and certification.

2) Optimization of testing processes and methods: Entities responsible for program testing and certification should continuously improve testing processes and methods for intelligent robot programs, design test plans covering various scenarios and cases to simulate real-world application scenarios comprehensively, enhancing the comprehensiveness and reliability of testing and certification, and reducing potential criminal risks resulting from testing limitations.

3) Enhancing technical training and education: Entities recognized through program testing and certification should strengthen technical training and education for test engineers and testing teams, enhancing their

understanding and emphasis on the safety of program testing and certification, thereby reducing the risk of crimes resulting from technical factors.

In light of the relationship between crimes resulting from out-of-control and malfunctioning intelligent robot programs and the natural persons (units) identified through program testing and certification, the following criminal law recommendations and improvement measures can be proposed:

1) Strengthening the legal liability system: Establishing and improving standards and procedures for determining the criminal liability of natural persons (units) responsible for testing and certifying intelligent robot programs, clarifying the criminal liability of natural persons (units) for intelligent robot-related crimes resulting from program testing and certification, and preventing vulnerabilities and abuses in legal liability.

2) Enhancing supervision and law enforcement: Strengthening supervision and law enforcement of natural persons (units) responsible for testing and certifying intelligent robot programs, cracking down severely on illegal activities during the testing process, and protecting the legitimate rights and interests of the public.

3) Improving laws and regulations: Enhancing relevant laws, regulations, and criminal law provisions regarding crimes related to intelligent robots, increasing the criminal liability of natural persons (units) identified through testing and certification of intelligent robot programs, and maintaining social security and order.

3.3 Criminal Law Regulations Related to the Association Between Crimes of Out-of-Control Intelligent Robot Programming and Their Users, i.e., Natural Persons (Units)

Potential risks and liability issues arising from program out-of-control are inevitable during the use of intelligent robots. Therefore, criminal law regulations targeting users, whether individuals or organizations, are employed to constrain and standardize their behavior (Liu Yanhong, 2021; Mauritz Kop, 2021).

First and foremost, users, whether individuals or organizations, are obligated to take legal responsibility for the actions of intelligent robots. As users, natural persons (units) must strictly adhere to all legal provisions during usage to ensure lawful operations. Should a robot commit a crime due to a user's unlawful operation, the user will be subject to criminal liability in accordance with the law.

Secondly, users of intelligent robots bear the responsibility to use them prudently and ensure safety. When operating an intelligent robot, users must fully comprehend its functional characteristics and safety requirements, and implement necessary protective measures to prevent criminal acts resulting from the robot going out of control. Failure by the user to fulfill these obligations effectively, leading to adverse consequences, will result in the user bearing corresponding criminal liability in accordance with the law.

Additionally, users must effectively supervise the operational behavior of intelligent robots. During the robot's operation, users should enforce strict management and monitoring, promptly identifying and appropriately addressing potential risks to prevent crimes resulting from situations where the robot goes out of control. If a robot commits a crime due to inadequate supervision, the user will also face legal liability.

Lastly, users of intelligent robots should closely collaborate with judicial departments and actively cooperate with relevant investigations and proceedings. In the event of a crime occurring due to the out-of-control situation of an intelligent robot program, users need to fully cooperate during the investigation process, providing necessary information and assistance to help ascertain the facts of the case and resolve the issue. Failure by users to actively cooperate with judicial authorities in investigations and proceedings, leading to difficulties in advancing the case, will result in users bearing corresponding responsibilities according to the law.

4. Objective Culpability Regulation for Out-of-Control Crimes Committed by Intelligent Robot Programs

The perpetrator of out-of-control behavior of intelligent robot programs is the intelligent robot itself, and the behaviors regulated by criminal law are not entirely equivalent to those of general societal behavior. Therefore, the attribution of objective behaviors in intelligent robot "crimes" primarily addresses two issues: how to identify the behavior in intelligent robot "crimes," and how to determine the specific perpetrator of behavior through the causal relationship between behaviors (Vincent Goding & Kieran Tranter, 2023; Begishev, I. R., 2022).

4.1 Determination of Objective Behavior in Out-of-Control Crimes Committed by Intelligent Robot Programs

Defining the objective behavior for out-of-control crimes committed by intelligent robot programs is a complex task and also crucial. Solutions to this problem require comprehensive consideration of the robot's behavior patterns, the designer's intentions, and the actual context, and rely on legal provisions and judicial interpretations for adjudication. The following are specific aspects of determining the objective behavior of out-of-control crimes committed by intelligent robot programs:

1) Definition of harmful behaviors: Initially, the primary task is to clearly delineate the harmful activities that may arise when the intelligent robot system loses control. These encompass damage to personal property, life, or

health, as well as any behavior that may disrupt social order or threaten public safety. When defining harmful behavior, both the actual impact of the behavior and its potential consequences should be considered comprehensively.

2) Determination of criminal behavior: Subsequently, an assessment must be made as to whether these out-of-control behaviors meet the criteria for criminal offenses. This involves referencing elements of criminal offenses in criminal law, such as intent and negligence, as well as relevant judicial interpretations and precedents. If the robot's behavior meets the conditions for offenses like intentional harm, theft, invasion of privacy, etc., it can be deemed criminal.

3) Identification of the executing behavior: Additionally, it is necessary to identify the specific actions constituting the robot's criminal behavior. This entails understanding the operational mechanism of the intelligent robot, the detailed process of program execution, and its interaction with the environment. Clarifying these behavioral details aids in analyzing the perpetrator of the criminal behavior and the specific execution steps, thereby more accurately assigning responsibilities.

4) Analysis of causality: When scrutinizing objective behavior, delving into the causal chain between the robot's out-of-control behavior and the resulting harm is crucial. This entails determining whether the robot's actions directly caused the harmful outcome and verifying the directness of this causal link. Such analysis typically relies on facts and evidence, including the action logs of intelligent robots, external environmental conditions, and other pertinent information.

5) Consideration of reasonable foreseeability: Finally, evaluating the foreseeability of the out-of-control behavior of an intelligent robot program is paramount. This involves assessing whether potential erroneous behaviors of the robot can be identified and prevented during the design, verification, and application phases. This exploration of reasonable foreseeability helps delineate the boundaries of liability for designers and users in cases of out-of-control crimes committed by intelligent robot programs.

In summary, identifying the objective behavior of out-of-control criminal behavior of intelligent robot programs necessitates an in-depth analysis of its multifaceted characteristics. Only through comprehensive consideration of the behavioral traits of intelligent robots, criminal law provisions, and specific circumstances can accurate determinations be made, ensuring fair legal judgments regarding criminal incidents caused by intelligent robots.

4.2 Standard Regulations on Attribution and Responsibility for Crimes Caused by Out-of-Control Intelligent Robot Programs

Compared with crimes committed by pure natural persons, establishing new standards is necessary for identifying causality and determining criminal liability when an intelligent robot program loses control. Given the specificity of intelligent robot programming, testing, certification, and usage, targeted regulations and standards need to be formulated to accurately determine the cause of behavior and the responsible party, ensuring that judicial proceedings are fair and reasonable.

1) Insist on determining causality based on the conditions

In identifying the causal relationship in out-of-control crimes committed by intelligent robot programs, adhering to the principle of determining causality based on conditional theory is essential. Conditional theory posits that the cause of an event arises from a combination of necessary conditions, which collectively lead to the event's occurrence. For out-of-control crimes committed by intelligent robots, conditional theory offers a systematic approach to analyzing the causes of events.

Firstly, conditional theory underscores the multifactorial nature of events. These crimes are often not the result of a single factor but arise from the interaction of multiple factors, including program design, testing and certification, and usage environment, necessitating a comprehensive consideration of these factors.

Secondly, conditional theory highlights the inevitability of events because all aspects of the intelligent robot program's out-of-control crime are indispensable contributing factors. Therefore, such events can only occur when all necessary conditions are fulfilled.

Finally, conditional theory provides criteria for assessing causality. Through thorough analysis and comparison of various factors, the key reasons for the incident can be identified, providing a solid basis for determining criminal liability. This approach prevents attributing blame solely to a single factor and instead offers a comprehensive and objective treatment of the entire incident.

Therefore, insisting on using conditional theory to define the causes of out-of-control crimes committed by intelligent robot programs is of significant importance. It can enhance the legal community's understanding of this complex issue and improve the accuracy and fairness of judicial decisions.

2) Adhere to the objective attribution theory to determine responsibility

In cases involving out-of-control crimes committed by intelligent robot programs, firmly applying the objective attribution theory to determine responsibility is crucial. This theory advocates defining responsibility based on objective facts and conclusive evidence of behavior, rather than on the subjective intentions or motives of the actor. Adopting this theory ensures the fairness and objectivity of responsibility, better safeguarding social fairness and justice.

Firstly, the objective attribution theory reduces reliance on the subjective motivation of the subject in legal judgments. Especially in cases where it is difficult to accurately discern the subjective intentions or motives of intelligent robot actors, as their behavior is often determined by programming or environmental influences rather than human desires. Therefore, applying the objective attribution theory reduces speculation on subjective motives and allocates responsibility more fairly and objectively.

Secondly, the objective attribution theory emphasizes the objective assessment of behavioral consequences. When dealing with out-of-control crimes committed by robots, focus should be on the actual impact of their behavior rather than overly fixating on the actor's intentions. Only through objective analysis of results can responsibilities be accurately assigned, and corresponding laws and regulations formulated.

Finally, the objective attribution theory helps maintain social fairness and justice, avoiding unfair treatment resulting from over-interpretation and reliance on subjective motives in handling crimes committed by robot programs out of control. Its application ensures the fairness of judicial decisions and guarantees equal rights and treatment for all before the law.

Therefore, using the objective attribution theory as a basis to identify crimes caused by out-of-control robot programs is crucial for promoting judicial fairness and maintaining legal order.

5. Regulation of Subjective Fault for Crimes Committed by Out-of-Control Intelligent Robot Programs

When determining the responsibility for crimes committed by out-of-control intelligent robot programs, the core focus should be on the natural persons (entities) "behind the scenes". Even though the intelligent robot is the actual executor, its actions are ultimately influenced by the design, management, and operation of natural persons (organizations). Therefore, the assignment of legal liability should be based on the intentions and actions of these natural persons (entities) to ensure fairness and accuracy in legal judgments and to uphold social equity and justice (Ildar Rustamovich Begishev, et al, 2023).

5.1 Determination of Subjective Fault for Crimes Committed by Out-of-Control Intelligent Robot Programs

In cases of crimes involving out-of-control intelligent robot programs, evaluating the subjective responsibilities of developers, test certifiers, and users is particularly crucial. This entails two key aspects: firstly, attributing responsibility to developers in artificial intelligence crimes; and secondly, categorizing the specific legal responsibilities borne by developers.

Firstly, it is imperative to consider whether developers, test certifiers, and users are culpable, whether due to negligence or intentionality. If a developer exhibits negligence, lacks due diligence, or disregards safety standards when creating an intelligent robot program, resulting in the program losing control and leading to a crime, it can be deemed as negligence. This indicates a failure to fulfill due care obligations during the design phase. Conversely, if a developer knowingly implants harmful code intentionally or disregards the risk of safety hazards, leading to the robot's engagement in illegal activities, it can be considered intentional behavior.

Secondly, determining the specific culpability of developers, test certifiers, and users requires a comprehensive analysis of their intentions, motivations, and implementation of preventive measures. If behavior is primarily driven by the pursuit of financial gain or personal interests, while neglecting security considerations, or even deliberately using the program for illicit activities, the culpability should be deemed severe. Moreover, if one fails to fully anticipate and take measures to prevent potential safety issues, thereby allowing potential risks to materialize, their culpability should also be subject to legal condemnation.

In conclusion, determining the subjective fault of developers, test certifiers, and users in crimes involving out-of-control intelligent robot programs necessitates a comprehensive consideration of the degree of negligence or intentionality in their actions, as well as the motives and purposes behind their behavior. Only by fully understanding the motives and intentions underlying the behavior, and considering whether the necessary duty of care and precautions have been fulfilled, can their subjective fault be accurately determined.

5.2 Subjective Negligence Regulations for Crimes Involving Out-of-Control Intelligent Robot Programs

In cases involving crimes committed by out-of-control intelligent robot programs, determining subjective fault is crucial for assigning liability and applying penalties. In contrast to intentional crimes, negligent crimes are generally perceived to be less subjectively malicious and harmful. It is common for intelligent robots to cause errors during operation due to loss of control or sudden obstacles. However, such accidents often fall beyond the control of the controllers of intelligent robots (such as designers and users), lacking the element of intentional

behavior.

For such scenarios, criminal law provisions typically consider negligence or accidents. Intelligent robots possess unique characteristics, with their operation predominantly controlled by designers and users. Hence, it is vital to clearly define the rights and obligations of designers and users, and rigorously regulate production management and usage processes to implement intelligent control from the outset. This has regulatory implications for robot-related crimes. Although intelligent robots may cause more significant harm and impact under similar conditions, unlike natural humans, their operations are steered by designers and users, with most possessing some degree of control capability.

Therefore, it is imperative to contemplate adopting a more lenient attribution principle and applying appropriate standards to developers, test certifiers, and users. This entails appropriately relaxing the determination of causality. Such an approach aims to bolster the management and restraint of their conduct to mitigate or eliminate instances of illegal activities perpetrated by intelligent robots. By enhancing the duty of care among developers, testers, and users, and refining the definition of causal relationships, intelligent robot behavior can be more effectively controlled to prevent instances of unauthorized actions or loss of control. It's essential to note that while accidents involving intelligent robots may not necessarily stem from the errors of developers, testers, and users, unforeseen circumstances and possibilities must be factored into liability assessments. Thus, for accidents resulting from programming errors or sudden malfunctions of intelligent robots, liability should be distinguished by referencing the degree of subjective negligence observed in natural persons. If the incident surpasses the control of a natural person, then exemption provisions for accidental events can be applied to strike a balance between legal liability and actual circumstances.

5.3 Enhancing the Regulation of Foreseeability Obligations for Crimes Involving Out-of-Control Intelligent Robot Programs

The obligation to foresee crimes committed by out-of-control intelligent robot programs is of paramount importance in criminal law regulation. Foreseeability obligations primarily stem from explicit means such as laws, regulations, and contractual systems, as well as implicit means such as professional standards, business requirements, and everyday life norms. To address the criminal behavior of out-of-control intelligent robot programs, foreseeability obligations can be proactively addressed from the outset, thereby reducing the harm caused by such programs through legal frameworks, regulatory mechanisms, institutional directives, or specific foreseeability obligations imposed on controllers of intelligent robots.

During the development phase of intelligent robots, if developers and test validators anticipate that an intelligent robot may exhibit erroneous behavior leading to harm during operation but proceed with production under the belief that such occurrences can be effectively prevented, their actions post-incident may be viewed as overconfident negligence. Conversely, if developers, test validators, and users are entirely unaware of potential risks, their failure to anticipate the outcome constitutes negligent oversight. Users bear legal responsibility for any errors resulting from the use of robots, whether intentional or negligent. Should a user disregard the instruction manual and cause self-harm, the product designer is not obligated to provide compensation; however, if harm is inflicted on a third party, the user must assume corresponding legal liability based on whether the negligence was due to overconfidence or oversight.

Furthermore, for developers and validators, if they have exercised due diligence and foresight in the design and validation process, but unforeseen consequences arising from the limitations of current knowledge surpass their cognitive scope, they should not be unduly criticized. To mitigate harm stemming from intelligent robot malfunctions, it is essential to establish robust specifications and safety standards for robot applications, bolster safety management practices, and enhance the foresight and care obligations of designers and users. All entities must also closely monitor and manage potential risk factors. In the realm of criminal law's regulation of intelligent robots, supervising the conduct of robot operators can be achieved by adjusting the duty of care concerning negligent offenses, thereby mitigating out-of-control illegal behaviors resulting from program errors. However, the provisions related to foreseeability obligations should remain within reasonable bounds to prevent undue constraints on the intellectual pursuits and behaviors of scientific and technical personnel, thus fostering rather than impeding scientific and technological advancement. Therefore, for technology applications with manageable risks and beneficial social value, it may be appropriate to moderate the obligation requirements for operators of intelligent robots, thereby promoting innovation and progress in intelligent robot technology.

6. Conclusion

This article delves into the legal regulation of crimes involving out-of-control intelligent robot programs, primarily encompassing criminal law regulations concerning program design, testing and certification, users, and regulators.

Firstly, during the program design phase, we propose that when determining the objective behavior of a crime

committed by an out-of-control intelligent robot program, an accurate judgment should be made based on the interplay between harmful behavior, criminal behavior, and execution behavior. Secondly, in the program testing and certification phase, we advocate for the use of conditional theory and objective attribution theory to ascertain responsibility, thereby distinguishing the entities responsible for the behavior in crimes involving out-of-control intelligent robot programs. Lastly, regarding users and regulators, we believe that the regulation of foreseeability obligations for crimes involving out-of-control intelligent robot programs should be bolstered. This entails establishing stringent safety management systems and foreseeability obligations to mitigate the risk of illegal activities stemming from program failures.

Future research endeavors are planned to address the following two issues:

Undertaking revisions of pertinent laws and regulations to establish punishment standards for crimes involving out-of-control intelligent robot programs.

Establishing an international regulatory and cooperative mechanism for crimes involving out-of-control intelligent robot programs to collectively address transnational activities of intelligent robot criminality, and safeguarding global network security and order.

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