

Research on the Application of Moral Judgment in the Field of autonomous vehicle

Yuzheng Li

Liaocheng University, Liaocheng, Shandong, 252059, China

ABSTRACT

This paper comprehensively discusses the decision-making problems of autonomous vehicle when facing moral dilemmas, and analyzes how individuals make moral judgments according to different moral behavior tendencies. This article also explains that in the inevitable accidents of autonomous vehicle, the moral choices people need to make are not only related to the technical level, but also touch on the deep moral concepts and values. The article not only discusses the public's preference for moral algorithms of autonomous vehicle, but also finds that people's moral judgments of human drivers and autonomous vehicle are different in different situations, and their decisions in moral dilemmas are affected by many factors, including decision-making modes, personal perspectives and situational factors. Finally, this paper emphasizes the importance of the humanized development of autonomous vehicle technology, and how to improve the public's understanding and acceptance of ethical decisions on autonomous vehicle through education and training.

KEYWORDS

Autonomous vehicle; Moral judgment; Moral decision-making; Utilitarianism; Deontology

1 Introduction

The autonomous vehicle represents the cutting-edge application of artificial intelligence technology and is committed to achieving fully autonomous operation without the need for human intervention. With the rapid advancement of autonomous driving technology, it has encountered a series of complex challenges in ethical decision-making. When faced with inevitable accidents, autonomous vehicle need to make moral judgments to decide how to minimize people's injuries and losses^[1]. This moral judgment not only involves technical issues, but also involves human moral concepts and values^[2]. The future development prospects of autonomous driving technology are highly controversial, mainly due to the public's ethical and psychological concerns about the potential casualties it may cause in emergency and non-standard traffic situations^[3]. Therefore, it is of great theoretical and practical significance to study the application of moral judgment in the field of autonomous vehicle.

2 Theoretical basis for moral judgment

When making moral judgments or evaluating the morality of behavior, individuals typically rely on two main theoretical frameworks: utilitarianism, which emphasizes maximizing overall well-being; The second is the theory of obligation, which emphasizes the absoluteness of adhering to moral norms^[4]. Utilitarianism holds that the moral correctness of an action depends on the overall happiness or benefit generated by its outcome. In the context of autonomous vehicle, utilitarian views may tend to choose decisions that maximize the overall interests, such as protecting more people's lives. Moreover, this viewpoint has received the highest support rate in traditional tram surveys^[5]. On the contrary, the theory of obligation emphasizes the moral nature of the behavior itself, rather than its consequences. According to the theory of obligation, certain actions are absolutely moral or immoral, regardless of their consequences. In the moral dilemma of autonomous vehicle, deontology may advocate following some basic moral principles, such as not harming others. The conflict between the above two moral theoretical frameworks profoundly reflects the internal tension of ethical decision-making of autonomous vehicle^[6]. The binary opposition between utilitarianism and deontology is essentially a game between the values of "result first" and "principle first". In technical practice, this tension is further externalized as an ethical dilemma in algorithm design: on the one hand, the utilitarian principle of "maximizing well-being" theoretically provides a clear mathematical decision-making path for autonomous driving (such as minimizing casualties); On the other hand, the insistence of the duty theory on the absolute norm of "non harm" reveals the limitations of relying solely on result based calculations.

3 Moral Development Theory and Cognitive Neuroscience

Kohlberg's theory of moral development suggests that an individual's ability to make moral judgments has specific

characteristics at each stage of their development^[7]. In the research field of autonomous vehicle, the application of moral development theory can help us gain insight into the attitudes and responses of individuals of different ages and cognitive development stages to the moral dilemma faced by autonomous vehicle. Cognitive neuroscience reveals the process of moral judgment by studying the neural mechanisms of the brain. Therefore, studying whether the brain regions related to moral judgment will also be activated when facing the moral dilemma of autonomous vehicle can provide neuroscience basis for us to understand the application of moral judgment in the field of autonomous vehicle.

4 Moral dilemma of autonomous vehicle

The trolley dilemma is a classic thought experiment in psychology that describes an extreme situation: a runaway trolley is heading towards five railway workers, and the only way to avoid this tragedy is to steer the trolley to another track with only one worker by pulling a rod. Similarly, in the ethical decision-making of autonomous vehicle, they may face a similar moral dilemma: make a choice between making an emergency turn to avoid hitting five people in front, and possibly sacrificing one pedestrian, or continue to go straight to protect the pedestrian but sacrificing five people^[8]. For example, autonomous vehicle need to make complex moral judgments in emergency situations, balance the conflict between protecting children's lives and abiding by traffic rules to avoid hurting adults on the sidewalk, which involves ethical decisions on different life weights and protection priorities^[9]. In the tram problem of autonomous vehicle, if we follow utilitarianism, we may need to sacrifice a few passengers to save more people. This is in contrast to the traditional non utilitarian approach of choosing to protect passengers and sacrifice pedestrians, and in the context of autonomous driving, proactive utilitarian decisions may result in passengers facing direct threats to their lives^[10].

5 Application research of autonomous vehicle

5.1 Moral algorithm preference for autonomous vehicle

The public tends to support self protecting autonomous vehicle rather than pure utilitarianism. Subsequent research further explored people's preferences for different moral algorithms. A study has found that people prefer mixed methods, which prioritize protecting passengers in emergency situations and adopt utilitarianism when dealing with pedestrians^[11]. This shows that the public expects autonomous vehicle to make a reasonable balance between self-protection and benefit maximization. This finding has guiding value for designing autonomous vehicle algorithms that meet moral expectations.

5.2 Differences in moral judgments between humans and autonomous vehicle

Existing research often ignores the difference in moral judgments between human drivers and autonomous vehicle, which is crucial to understanding the public's moral expectations of autonomous vehicle and optimizing their design. Previous studies have found that people tend to give more severe criticism to errors in artificial intelligence driving, and the intensity of such criticism is proportional to the severity of the damage caused^[12]. People tend to make utilitarian decisions in the context of human driving, which may be related to the fact that human driving is closer to daily life and encourages people to consider the overall interests. Researchers have used VR devices to simulate the authenticity of scenarios from different character perspectives, exploring people's moral judgments in autonomous driving and human driving, and revealing the influence of roles and perspectives on moral judgments. These studies indicate that the authenticity of the situation and the perspective of individual roles are key factors influencing moral judgments. Therefore, these factors must be comprehensively considered when designing the moral decision system of autonomous vehicle to ensure that its decisions are consistent with the moral expectations of the public.

5.3 Decision factors in moral dilemmas

In the moral decision-making of autonomous vehicle, many factors, such as decision-making mode, personal perspective, situational factors and the inference of passenger control, shape people's moral choices. Under the mode of intuition and thoughtful decision-making, people tend to have different moral orientations of deontology and utilitarianism. Personal perspective significantly affects decision-making, such as passenger perspective tending towards self-protection, while pedestrian perspective is the opposite. When increasing the number of passengers, utilitarianism tends to strengthen, while the influence of passenger age and seat position on decision-making indicates that people's inference of passenger control plays a role in moral judgment. Violation of social norms, such as pedestrians crossing illegally, also significantly increases their likelihood of being sacrificed^[13].

5.4 Empathy and Personality Influence the Ethical Acceptance of Autonomous Driving

Some studies have revealed the key role of empathy in moral decision-making of autonomous vehicle, and found that high empathy individuals are more inclined to accept utilitarian autonomous vehicle that sacrifice fewer people, while low empathy individuals have no obvious preference for moral orientation when their personal interests are not threatened, but prefer self-protection vehicles when they may sacrifice themselves^[14]. The personality traits of drivers are key factors in predicting behaviors that may endanger their own safety^[15]. Studying them can help enhance user trust and promote acceptance of autonomous driving technology, achieving a harmonious unity between personalized driving experience and user values.

6 Summary and Prospect

This paper deeply analyzes the complexity of moral judgment in the field of autonomous vehicle, and reveals the psychological mechanism and decision-making process of individuals in the face of related moral dilemmas. Based on the individual's utilitarianism and deontological behavioral tendencies, this paper discusses the response of individuals with different behaviors to the moral decision-making of autonomous vehicle. At the same time, moral development theory and cognitive neuroscience provide a scientific basis for extending the research on moral judgment in the moral dilemma situation caused by autonomous vehicle. In addition, this study also shows the influence of moral algorithm preference, empathy and personality traits on the choice of autonomous vehicle. Future research can further explore the relationship between research paradigms and moral decision-making of autonomous vehicle, especially the cognitive and emotional processes in understanding how individuals deal with moral dilemmas related to autonomous vehicle. In addition, with the development of automatic driving technology, psychological research can provide theoretical support for the design of algorithms that are more consistent with human moral intuition, and explore how to improve the public's understanding and acceptance of moral decisions of autonomous vehicle through education and training. Finally, psychological research will help promote the humanized development of autonomous vehicle technology, and ensure that it is consistent with users' needs and expectations in moral and psychological aspects.

References

- [1] Gawronski B, Brannon S M. Power and moral dilemma judgments: Distinct effects of memory recall versus social roles[J]. *Journal of Experimental Social Psychology*, 2020, 86:103908.
- [2] Kallioinen N, Pershina M, Zeiser J, Nezami F N, Pipa G, Stephan A, König P. Moral judgements on the actions of self-driving cars and human drivers in dilemma situations from different perspectives[J]. *Frontiers in Psychology*, 2019, 10.
- [3] Frank D, Chrysochou P, Mitkidis P, Ariely D. Human decision-making biases in the moral dilemmas of autonomous vehicles[J]. *Scientific Reports*, 2019, 9(1).
- [4] Cushman F, Young L, Greene I D. Our multi-system moral psychology: Towards a consensus view[C]. In: Doris J M, ed. *Oxford Handbook of Moral Psychology*. Oxford: Oxford University Press, 2010.
- [5] de Melo C M, Marsella S, Gratch J. Risk of injury in moral dilemmas with autonomous vehicles[J]. *Frontiers in Robotics and AI*, 2021, 7:572529.
- [6] Cohen D J, Ahn M. A subjective utilitarian theory of moral judgment[J]. *Journal of Experimental Psychology: General*, 2016, 145(10):1359–1381.
- [7] Bruno G, Spoto A, Lotto L, Cellini N, Cutini S, Sarlo M. Framing self-sacrifice in the investigation of moral judgment and moral emotions in human and autonomous driving dilemmas[J]. *Motivation and Emotion*, 2023, 47(5):781–794.
- [8] Himmelreich J. No wheel but a dial: Why and how passengers in self-driving cars should decide how their car drives[J]. *Ethics and Information Technology*, 2022, 24(4).
- [9] Bergmann L T, Schlicht L, Meixner C, König P, Pipa G, Boshammer S, Stephan A. Autonomous vehicles require socio-political acceptance—An empirical and philosophical perspective on the problem of moral decision making[J]. *Frontiers in Behavioral Neuroscience*, 2018, 12.
- [10] Lotto L, Sarlo M, Manfrinati A. A new set of moral dilemmas: Norms for moral acceptability, decision times, and emotional salience[J]. *Journal of Behavioral Decision Making*, 2014, 16(20):6513–6525.
- [11] Sui T. Exploring moral algorithm preferences in autonomous vehicle dilemmas: An empirical study[J]. *Frontiers in Psychology*, 2023, 14.
- [12] Hong J W, Wang Y, Lanz P. Why is artificial intelligence blamed more? Analysis of faulting artificial intelligence for self-driving car accidents in experimental settings[J]. *International Journal of Human–Computer Interaction*, 2020, 36(18):1768–1774.
- [13] Li S, Zhang J, Li P, Wang Y, Wang Q. Influencing factors of driving decision-making under the moral dilemma[J]. *IEEE Access*, 2019, 7:104132–104142.
- [14] Chen N, Zu Y, Song J. Research on the influence and mechanism of human–vehicle moral matching on trust in autonomous vehicles[J]. *Frontiers in Psychology*, 2023, 14.
- [15] Ju U, Kang J, Wallraven C. To brake or not to brake? Personality traits predict decision-making in an accident situation[J]. *Frontiers in Psychology*, 2019, 10.