



PART 3

Read the text below and answer questions 27–40.

THE ETHICS OF AUTONOMOUS VEHICLES: THE TROLLEY PROBLEM REVISITED

A

Autonomous vehicles are usually introduced through a technical vocabulary of sensors, maps, and machine learning. Yet the most controversial questions are moral and legal, because the behaviour of an automated system is designed in advance rather than improvised in the moment. A human driver confronted with danger may react through instinct, training, or panic; an automated vehicle expresses priorities that have been embedded through engineering choices, testing regimes, and corporate decisions. This shift turns rare crashes into public questions: if harm cannot be avoided, whose safety is prioritised, and who is responsible when a system's "choice" produces injury?

B

Public discussion often relies on the trolley problem, a thought experiment about whether it is permissible to harm one person to save several others. In the context of autonomous vehicles, the puzzle becomes operational: should a car be coded to swerve away from a crowd if doing so increases risk to its passenger, or should it always protect the occupant? The appeal of trolley scenarios is their clarity, but that clarity is also their weakness. Real road emergencies are characterised by uncertainty, incomplete information, and limited time to interpret what is happening. A system rarely confronts two clean outcomes that are known in advance; it confronts probabilities, ambiguous objects, and constrained physics. Critics therefore argue that focusing on trolley-style dilemmas can misrepresent the kinds of decisions that actually dominate safety.

C

Engineers typically distinguish between crash avoidance and crash optimisation. The central aim of automation is to prevent collisions through conservative driving, reliable detection, and early braking, so that forced-choice scenarios are vanishingly rare. However, "rare" is not "never." Edge cases persist: sensor occlusion by large vehicles, sudden pedestrian movement, unusual road markings, or adverse weather that degrades perception. Ethics therefore becomes partly a question of residual risk: what level of failure is acceptable, how is it distributed across road users, and what safety margins are chosen when speed, comfort, and efficiency compete with caution? In this framing, moral debate is less about dramatic last-second sacrifice and more about the everyday calibration of risk under uncertainty.



D

Even when an outcome looks like a moral decision, it may be the product of layered technical processes rather than a single ethical rule. Perception systems classify objects; prediction systems estimate trajectories; planning systems generate manoeuvres; and control systems execute them under physical constraints. Error can occur at any layer. A vehicle might “choose” a dangerous path because it misclassified a cyclist, underestimated braking distance, or failed to detect a pedestrian in poor lighting. The harmful result would not reflect a deliberate decision to value one life over another, but a failure mode shaped by data limitations, design priorities, and incomplete validation. This complicates accountability because harm can arise from how the system was trained and tested rather than from an explicit instruction to trade one person against another.

E

The legal landscape adds another constraint. Many traffic rules expect rule-following behaviour rather than welfare maximisation. Swerving across a lane line, mounting a kerb, or entering oncoming traffic can be illegal even if it seems to reduce expected harm. Manufacturers and regulators therefore confront a tension between moral intuitions and legal compliance. This also feeds a liability gap: if a crash occurs, responsibility may be unclear. Is the manufacturer liable for design and testing choices? Are software developers responsible for an error produced by complex learning systems? Should the passenger be treated as a “driver” when they did not control the car? Because autonomous vehicles distribute agency across humans and software, existing categories of fault can look inadequate.

F

Fairness concerns broaden the debate beyond single crashes. Automated systems are developed and validated in particular environments, and performance may differ across neighbourhoods, lighting conditions, road cultures, and weather. If detection is less accurate for certain groups because of unbalanced datasets or insufficient testing, then risk is unevenly allocated. This creates an ethical requirement for evaluation across diverse conditions and for transparent reporting of where systems fail. Without such scrutiny, automation could improve average safety while leaving specific communities exposed to higher residual risk. Ethical deployment would therefore include mechanisms for independent auditing and for withdrawing systems that underperform in particular contexts.

G

Public preferences add yet another layer. Surveys repeatedly find a tension between what people say is morally desirable and what they want for themselves. Many endorse vehicles



that minimise total harm in principle, a utilitarian intuition. Yet many also prefer to ride in cars that prioritise their own passengers, reflecting self-protective instincts. Research such as the MIT Moral Machine project suggests that moral intuitions vary across cultures, with different societies placing different weight on age, rule-following, or social roles. If companies were allowed to market “self-protective” settings, competitive pressure could push design away from collective welfare, producing a fragmented moral landscape where safety depends on consumer purchasing power.

H

Because autonomous vehicles impose shared risks on the public, governance becomes central. Proposals include mandatory safety benchmarks, independent auditing of algorithms, and event data recorders that preserve information about system behaviour before a crash. Others advocate explainability requirements so investigators can understand why a system acted as it did, reducing the temptation for organisations to hide behind complexity. Yet transparency also has limits: detailed disclosure can expose proprietary technology or create security vulnerabilities. Policymakers must therefore balance accountability with innovation and safety, while clarifying who carries responsibility when software mediates life-and-death outcomes.

I

In this context, the trolley problem remains useful mainly as a prompt rather than an engineering blueprint. The deeper ethical issue is how societies manage trade-offs under uncertainty: what risks are tolerated, who benefits, and who bears the remaining harm. If autonomous vehicles substantially reduce overall fatalities, many argue that adoption can be justified even if the technology is imperfect. But legitimacy will depend on whether testing is rigorous, whether performance is fair across contexts, and whether accountability structures are trusted by the public.

Questions 27–33

Choose the correct heading for each paragraph.

List of Headings

- i How consumer preference can undermine collective welfare
- ii Why trolley-style dilemmas oversimplify real-world emergencies
- iii The ethical significance of residual risk and safety margins
- iv When a moral “choice” is actually an engineering failure
- v Rule compliance, liability, and the problem of distributed responsibility
- vi The shift from human instinct to engineered priorities
- vii Unequal safety produced by uneven testing and biased data



viii Governance tools and the transparency dilemma

ix The trolley problem as a complete blueprint for coding vehicles

x When imperfect technology may still be considered worth adopting

27 Paragraph **A**

28 Paragraph **B**

29 Paragraph **C**

30 Paragraph **D**

31 Paragraph **E**

32 Paragraph **F**

33 Paragraph **G**

Questions 34–37

Complete the summary below. Choose **NO MORE THAN TWO WORDS** from the text for each answer.

Ethical challenges in autonomous vehicle design

A human driver faced with danger might act instinctively, rely on training, or react in

34 An apparently moral decision by an automated vehicle may instead result from a technical error, such as wrongly identifying a **35** Performance can vary with factors such as location, lighting, road culture, and **36**, so testing must cover a wide range of settings. The MIT **37** project is cited as evidence that moral preferences differ across cultures.

Questions 38–40

Select the correct answer.

38 What is the main point of Paragraph **C**?

A Most AV crashes are best handled by choosing the option that saves the greatest number of people.

B Ethics is closely tied to crash avoidance and how any remaining risk is distributed.

C Better mapping alone can eliminate edge cases such as occlusion and unexpected pedestrian behaviour.

D Engineers should prioritise crash optimisation over crash avoidance because failures are unavoidable.



39 What concern is raised about allowing consumers to select “self-protective” AV settings?

- A** It would make AVs legally responsible for every crash regardless of fault.
- B** It would reduce the accuracy of perception systems by increasing computational load.
- C** It could encourage competition that shifts behaviour away from social welfare.
- D** It would mainly increase risk in high-speed motorway driving rather than in cities.

40 What is the writer’s overall conclusion about the trolley problem in AV ethics?

- A** It functions mainly as a prompt; the deeper issue is trusted rules and accountability for trade-offs under uncertainty.
- B** It provides a practical blueprint for coding AVs to make correct moral choices in emergencies.
- C** It shows that ethical programming is impossible, so AV deployment should be delayed indefinitely.
- D** It is irrelevant because AVs will always be able to avoid collisions with sufficient training data.

Answer Key

27. vi

28. ii

29. iii

30. iv

31. v

32. vii

33. i

34. panic

35. cyclist

36. weather

37. Moral Machine

38. B

39. C



40. A