

Cultural Orientation Shapes Moral Judgments of Autonomous Vehicle Dilemmas

Eda Isil Sukan*
University of Groningen
Groningen, Netherlands
e.i.sukan@rug.nl

Augusto Bovesi
Università di Siena
Siena, SI, Italy
a.bovesi@student.unisi.it

Stefano Guidi*
Università di Siena
Siena, SI, Italy
stefano.guidi@unisi.it

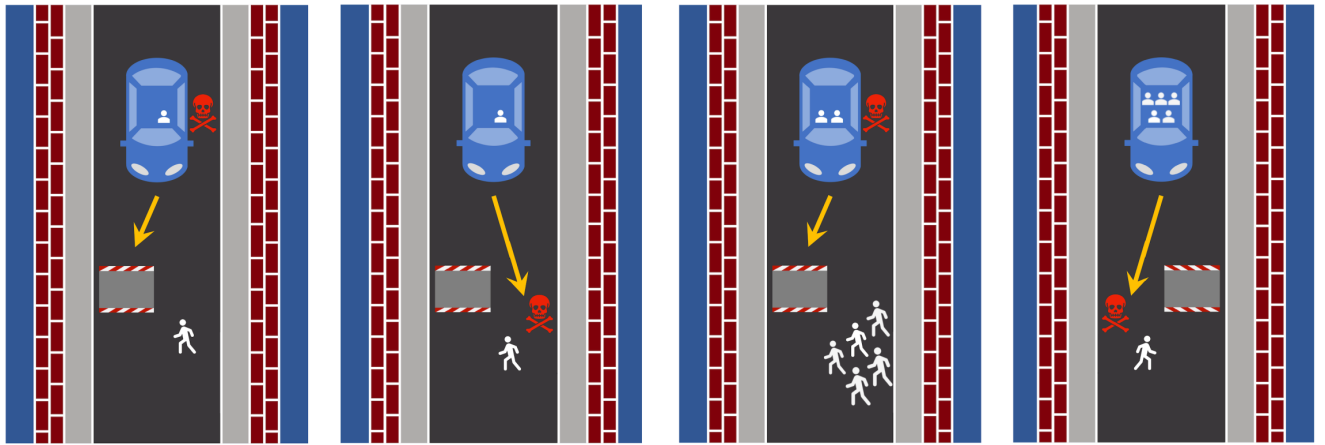


Figure 1: Passenger-vs-pedestrians dilemmas

Abstract

Autonomous vehicles (AVs) promise enhanced road safety but face acceptance challenges due to unavoidable moral dilemmas, particularly passenger-pedestrian conflicts. Cultural orientation may influence moral evaluations of AV decisions, yet its effects remain underexplored. Here we conducted an online survey with 346 participants from individualistic (US, Italy) and collectivistic (Turkey, Indonesia) cultures, manipulating the number of lives at stake. Results revealed a modest overall preference for pedestrian-protective choices, modulated by contextual factors and cultural orientation, with collectivist individuals favoring pedestrian protection more. These findings suggest that to enhance public acceptance, AV technologies should be designed with different moral preferences depending on the cultural context in which they have to be used.

CCS Concepts

• Social and professional topics; • Applied computing → Transportation;

*Both authors contributed equally to this research.



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Keywords

Autonomous Vehicles; Moral Decision-Making; Cultural Orientation; Passenger-Pedestrian Dilemma; Individualism–collectivism

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1 Introduction

Autonomous vehicles (AVs) represent a significant shift in the transportation and automobile industry, with the potential to greatly reduce accidents caused by tired, distracted, or impaired drivers, thereby saving countless lives [9]. However, despite these anticipated benefits, public acceptance remains limited [6], in part due to the complex moral dilemmas AVs introduce. Even a flawlessly engineered self-driving car cannot guarantee that accidents will never occur, raising the challenging question: when a crash becomes unavoidable, how should the car decide what to do?

This question has been primarily addressed through the lens of trolley-dilemma-style scenarios [10, 37], in which a vehicle must choose between two courses of action, each leading to harm to a different party. The most prominent of these is the passenger–pedestrian dilemma, in which the AV must decide whether to protect the occupants of the vehicle or the individuals outside it. Although some have criticized the relevance of these studies [16, 32], Gill [13] demonstrated that ethical dilemmas are rated by users as the most important issue facing AV development surpassing concerns about

technical reliability, legal accountability, and privacy. This finding underscores that the moral questions debated by researchers are also central to potential users' decisions about whether to trust, purchase or use an autonomous vehicle. Therefore, it is crucial to understand what people expect AVs to do in these scenarios to maximise adoption and societal benefits. It is also important to consider how people's preferences for AV choices in ethical dilemmas might vary across cultures, since it is well known that values and even self-concept vary substantially across cultures [17].

This paper investigates cross-cultural differences in the preferences for AV decisions in passenger-pedestrian dilemmas. The following section reviews the literature about moral preferences for AV decisions, including studies on cross-cultural differences in responses to classical trolley dilemmas and AV-specific scenarios. Subsequently, we present an empirical study designed to address research questions and test hypotheses derived from the literature review.

2 Related works

2.1 Preferences for passenger- vs pedestrian-protective choice by AV

The literature on moral decisions made by AVs in passenger versus pedestrian dilemmas has produced mixed results. Pioneering research, most notably the global Moral Machine experiment [1], revealed that while people broadly endorse the utilitarian principle of minimizing casualties, they also tend to prefer vehicles that would protect their own passengers. Several studies have shown a preference for sacrificing passengers rather than pedestrians [5, 11, 20, 24, 25, 28, 29, 42]. Passenger-protective choices also appear to be preferred more in speeded decisions [11, 39]. However, this preference is modulated by perspective taking: assuming the perspective of the passenger reduces preference for pedestrian-protective choices, while assuming the pedestrian perspective increases it [11, 20, 27, 28]. Some studies, however, have found a preference for passenger protective choices in moral evaluations and acceptability [12]. Bonnefon et al. [4], first noted that public acceptance of AVs may hinge on resolving the tension between what is considered morally correct and what individuals desire for themselves in terms of safety measures on board their vehicles. Several studies have found a lower preference for AVs making pedestrian-protective choices compared to analogous decisions made by human drivers [6, 12, 24]. Sacrificing passengers reduces the influence of utilitarian norms in moral decision making [6], and tend to be negatively associated with interest in adopting AVs [27]. Gill [13] also found that participants favored passenger-protective AV programming when asked directly, and that this preference grew stronger among those more interested in the technology. This is consistent with results from studies on takeover decisions in Level-3 AVs¹, which have shown that when drivers are informed that the vehicle intends to sacrifice them, self-preservation bias strongly dominates, with the vast majority of participants choosing to intervene and override the AV [19]. Dong et al. [7] also showed

that passenger-sacrificing decisions made by an AV elicit higher negative emotions than corresponding human decisions, while the opposite was found for passenger-protective choices, which elicited less anger and contempt and more gratitude and elevation when made by an AV than by a human driver.

Individual preferences for pedestrian- versus passenger-protective AV decisions also seem to depend on personal and cultural values. Yoo et al. [42] found that individuals with stronger family bonds favored cars programmed to protect their family members, even at the expense of harming pedestrians, whereas people with higher levels of altruism tended to prioritize protecting pedestrians, even if they were strangers.

2.2 Cultural differences in AV perception

By involving more than 40 million participants from more than 200 countries, the Moral Machine experiment [1] was able to reveal differences and similarities in moral preferences of participants across cultural clusters (broadly grouped as Europe and the United States, East Asia and South America). The universal tendency gathered from the results was that participants, across all countries, generally preferred the utilitarian approach of minimizing total casualties, but also showed a general preference for a vehicle that protects them personally. Collectivist societies, however, showed greater preference for saving groups or authority figures than more individualistic societies favoring equality among potential victims.

In a follow-up large-scale study Awad et al. [2] found further proof of universal patterns and cultural variation. The study presented participants from 42 different countries multiple versions of the trolley dilemma and demonstrated that participants in all countries were more willing to accept a sacrifice in the switch version of the dilemma than in the loop or footbridge versions. Participants from countries with lower relational mobility (more socially closed societies), however, were proportionally less willing to sacrifice one person to save many, an effect that was prominent in East Asian countries, where such a sacrifice may be interpreted as a violation of social respect and cohesion. A further large-scale study using different versions of the trolley dilemma in 45 countries failed to confirm the prediction that collectivist cultures would favor less utilitarian decisions due to higher emphatic concerns [3]. The results showed that psychological factors regarding whether the harm required direct physical force and whether it was intentional predicted moral judgements arguably more robustly than broader cultural dimensions such as individualism or collectivism. The interaction between force and intention to harm, however, was more pronounced in Western cultures. While the overall findings still support the pattern that cultural differences in moral judgements are real, this study suggests that they are limited in scope and highly context-dependent.

Several other studies have investigated cross-cultural differences in the perception of AVs and their choices. Edelman et al. [8] tested how participants from China, Germany, Japan and the United States evaluated different decisions of AVs on a highway. The decisions varied in terms of the level of risk and hindrance posed to other road users. Chinese participants showed uniformly high acceptance across all scenarios, whereas American and German participants rejected decisions that caused significant hindrance to others but

¹In the taxonomy of automation levels for vehicles developed by SAE International, level 3 ("Conditional automation") corresponds to systems that have the responsibility for controlling direction and speed of the vehicle, and for monitoring the environment, while the "Driver must appropriately respond to a request to intervene." [18]

accepted overtaking in low-hindrance conditions. In a parallel fashion, Japanese participants rejected hindrance-causing decisions. These results confirmed that the cultural context in which AV behavior is evaluated significantly shapes its public acceptance, even in scenarios that do not involve direct harm to individuals.

Rhim et al. [34] approached the cultural dimension from a different perspective arguing that ethical decision-making in the context of AVs involves both intuitive and rational processes that are shaped by personal and cultural factors. The study showed that Eastern participants were more likely to adopt a situationalist approach, weighing the specific context and the relationships involved. On the other hand, Western participants applied more rule-based principles. These authors explained how ultimate moral intentions depend on the perception of the situation's moral intensity, which is influenced by personal and cultural values, and propose a "hybrid" model of moral pluralism to clarify how AVs' decisions may vary across different social groups.

Kim and Wang [21] examined this key question further in an online experiment with 1,500 participants from the United States, Hong Kong and China. Surprisingly, the type of decision (passenger vs pedestrian protective) and decision maker did not significantly impact ethical judgements, attitudes toward AVs or purchase intentions on their own. What did matter was regional background, with Chinese participants evaluating AVs as less ethically acceptable than participants from the United States and Hong Kong, who responded similarly to one another. It was found that collectivism mediated the effect of regional differences on purchase intentions, perceived safety and perceived intelligence, though not on ethical judgements directly. The results suggest that while not straightforwardly affecting the responses to ethical dilemmas, cultural background shapes the overall reception of AV technology.

Finally Teychenié et al. [36] tested the joint effect of autonomy level, moral programming and accident severity on trust in AVs across the United States, Mexico and China. Their results show that utilitarian style programming increased trust in the United States and Mexico samples, but only in high-severity accident conditions, while in China the same programming style increased trust only in mild accident conditions and actually undermined it in severe ones. This remarkable reversal illustrates that the relationship between moral programming and public trust in AVs is not uniform across cultures and that cultural background can significantly alter the direction, not just the magnitude, of these effects.

Taken together these studies paint a nuanced picture: while some moral intuitions seem to be broadly shared across cultures, cultural background (individualist versus collectivist) shapes how people evaluate AV behavior, how much they trust AVs and how willing they are to adopt them. To capture this cultural variation more precisely Triandis and Gelfand [38] proposed a finer-grained framework distinguishing between vertical and horizontal forms of both individualism and collectivism, differentiating societies characterized by hierarchical role distinctions from those emphasizing equality. Although this framework has seen limited application in AV research to date, it offers a more nuanced lens for examining cultural differences, and evidence from the AV acceptance literature suggests it may be relevant: Naderi and Nassiri [30] found that individuals with more collectivist orientations show greater propensity to accept AVs and respond more favorably to messages emphasizing

their social benefits suggesting that cultural orientation may shape not only abstract moral preferences but also the practical reception of AV technology.

3 The study

The study aimed to investigate how people morally evaluate passenger-versus pedestrian-protective decisions made by AVs in unavoidable road accident scenarios, and whether these evaluations are shaped by the cultural orientation of participants. To this end, we recruited a sample including participants belonging to both individualistic and collectivistic cultures, and collected judgments about AV decisions in an online survey, manipulating the choice made by the AV (saving passengers vs. saving pedestrians), the number of passengers on board, and the number of pedestrians on the road as within-subject variables.

3.1 Research questions and hypotheses

The study was designed to address the following research questions and to test the associated hypotheses.

RQ1. Is there a systematic preference for passenger vs pedestrian protective choices made by AV in road dilemmas?

HP1. Based on previous research, we expect a general preference for pedestrian-protective choices, consistent with the utilitarian norm of minimizing the overall number of casualties [1]. However, we also expect this preference to be modulated by the number of passengers and pedestrians involved: as the number of pedestrians increases relative to passengers, preference for pedestrian-protective choices should strengthen, while an increase in the number of passengers should reduce it [5, 28, 29]. Given the tension between utilitarian ideals and self-protective instincts documented in the literature [4, 19], we expect the overall preference for pedestrian-protective choices to be modest in magnitude.

RQ2. Does the preference for passenger vs pedestrian protective choices in road dilemmas vary with the cultural orientation of participants?

HP2. We expect that participants with higher levels of collectivistic orientation will show a greater preference for pedestrian-protective choices than participants with more individualistic orientations. This prediction is grounded in the previous study by Awad et al. [1] that collectivistic cultures tend to prioritize group welfare and show greater acceptance of utilitarian outcomes. Recent findings of [30, 36] further suggest that collectivistic individuals respond more favorably to socially-oriented framing and show higher acceptance of AVs programmed to maximize collective benefit. However, given that the relationship between cultural orientation and moral judgment is not always straightforward [3], we expect these effects to be modestly present.

4 Method

4.1 Participants

We recruited 346 participants for the study. Participants were purposely recruited from four different countries through the Prolific platform, two considered to have an individualistic culture (US and Italy, $N = 97$ and 92 respectively) and two considered to have a collectivistic culture (Turkey and Indonesia, $N = 91$ and 66 respectively). Recruitment was carried out by specifying participants'

nationality and native language. The selection of the countries from which the samples were taken was based on the scores on the individualism cultural dimensions for each country in the VSM 2013 [17], ranging from 1 to 100 where high scores indicate more individualistic culture (Indonesia: 14; Turkey: 37; US: 91; Italy: 76).

Participation was voluntary and compensated (1 GBP). The mean age of participants was 35.3 ($SD = 10.4$), and the sample included 176 men (50.7%), 168 women (48.4%) and 3 persons reporting a non-binary gender (0.86%).

4.2 Design and procedure

During the experiment, participants were asked to evaluate the moral acceptability of the actions taken by an AV in a series of driving dilemmas in which the AV has to choose between saving the passengers in the vehicle and saving some pedestrians on the road. Each participant was presented with 18 scenarios, generated by the factorial combinations of the levels of three within-subject variables: the *choice* made by the AV (saving the pedestrians vs saving the passengers), the *number of passengers* on board (1, 2, or 5), and *number of pedestrians* on the road (1, 2, or 5). Therefore the experiment used a $4 \times 2 \times 3 \times 3$ mixed factorial design.

The experiment was implemented as an online survey on the Limesurvey platform, in four different languages (IT, EN, TR, IN). Initially participants were informed about the purpose of the study and the procedure, and of their rights according to the Declaration of Helsinki. After obtaining the informed consent, a definition of AVs was provided as “(...) cars that can drive completely by themselves and move through traffic without the need for human intervention”, and participants were instructed that their task would involve judging the moral acceptability of AV decisions in different situations in which an accident is unavoidable.

In each scenario, a vehicle is traveling on a road and suddenly encounters an unavoidable obstacle, while a pedestrian is present on the other side of the road. The decision-maker must choose between two possible actions: crashing into the obstacle, thereby saving the pedestrian but sacrificing themselves and any passengers on board, or avoiding the obstacle and hitting the pedestrian, thereby saving themselves and the passengers but causing the pedestrian's death. Each scenario was presented with a textual description and a graphical image representing the condition from a bird's-eye view. The image showed the outcome with an arrow indicating the chosen action. The position of the obstacle and the pedestrian was randomized across scenarios, so that they could appear either on the left or on the right. In Figure 1 are presented some of the images used in the experiment to represent different scenarios and decisions. The order of scenario presentation was randomized to control for order effects. Below the image and texts with the scenario description, participants were asked to rate the moral acceptability of the decision on a rating scale ranging from 1 = very reprehensible to 6 = very justifiable.

Following the scenario judgments, participants completed a questionnaire collecting biographical information, including age and gender, and including the INDCOL cultural orientation scale [38], consisting of 16 items and four subscales: horizontal individualism

(HI, $\alpha = 0.66$), vertical individualism (VI, $\alpha = 0.75$), horizontal collectivism (HC, $\alpha = 0.75$), and vertical collectivism (VC, $\alpha = 0.78$). Finally, participants had to answer a short set of questions about their driving and transportation experience and they were presented with the 4 items of the Attitudes toward Artificial Intelligence Scale (AIAS-4, [14]), each answered on a 10-point agreement response scale. The average duration of the experiment was approximately 9 minutes. The procedure and the materials used in the experiment were approved by the Ethical Committee of the University of Siena (act. N. 07/2025).

4.3 Data analysis

Descriptive statistics were computed for socio-demographic variables and scale scores, including means and standard deviations for numerical variables and frequency tables for categorical variables. The main analyses were conducted with Linear Mixed-effects Models (LMM) comparing moral acceptability judgments across conditions. Cultural orientation, number of participants and number of occupants and their interactions were included as fixed effects in the model, using sum coding for the categorical predictors, and including a random intercept for participants. Participants' age and individual AIAS scores (standardized) were included as covariates in the model. All the analyses were performed using R (version 4.4.2 [33]), and the packages *afex* [35] and *emmeans* [23].

5 Results

5.1 Design and manipulation checks

To establish whether our operationalization of the cultural orientation, based on selecting participants from two collectivist and two individualistic countries, we compared the individual scores on the INDCOL dimensions across cultural and national samples. The results of the comparisons were not in line with the expectations: while participants in the collectivist sample had significantly lower HI scores than participants in the individualist sample ($p = .026$), they had significantly higher scores on VI ($p < .001$), and the samples did not differ significantly on HC and VC levels. Moreover, also at the level of the individual countries (Table 1) we observed differences in the scores which were not in line with the expectations. Indonesians had the highest levels of VI, significantly higher than those of Italian and US participants. US participants, on the other hand, had significantly higher levels of HC than Turkish participants, and levels of HC and VC were not different to those of Indonesian and Turkish participants. We therefore relied on the INDCOL scores themselves to classify participants as having high or low levels of alignment with each type of cultural orientation, based on the median found in the sample for each dimension.

5.2 Preference for pedestrian-protective choices

The results of the analyses showed first of all a slight, but significant, moral preference for the pedestrian-protective choice over the alternative, passenger-protective decision ($M = 0.68$, 95% CI [0.49, 0.86], $p < .001$), averaging across all the other factors. Not surprisingly, the results showed that the preferred choice was significantly affected by contextual factors, the number of pedestrians ($F(2, 2640) = 392.8$, $p < .001$), the number of passengers ($F(2, 2640) = 343.5$, $p < .001$) and their interaction ($F(4, 2640) =$

Table 1: Mean scores for the cultural orientation dimensions in each national sample. Standard deviations are reported in parentheses. Within each row, means that do not share a subscript are significantly different.

	IN N = 66	IT N = 92	TR N = 91	US N = 97	p-value
VI	6.22 _a (1.12)	4.67 (1.54)	5.68 _{ab} (1.46)	5.49 _b (1.77)	<0.001
HI	6.91 (1.09)	7.33 _a (1.14)	7.37 _a (0.95)	7.54 _a (1.09)	0.003
VC	6.57 _a (1.51)	5.83 (1.57)	6.59 _a (1.41)	6.94 _a (1.51)	<0.001
HC	6.38 _{ab} (1.11)	6.04 _a (1.44)	6.62 (1.30)	7.14 _b (1.20)	<0.001

2.78, $p = .025$). In line with utilitarian norms, the number of pedestrians increased the preference for pedestrian-protective choices, while the number of occupants decreased it. The mean preference scores as a function of the number of pedestrians and of passengers are plotted in Figure 2.A. As it can be seen in the figure, in all the conditions in which the number of passengers was equal to the number of pedestrians a significant preference for pedestrian-protecting choices was found, and only when this choice was not utilitarian with respect to the alternative choice, the opposite preference was found. Age was not associated with choice preference, but attitude toward AI, as measured by the AIAS-4, was ($F(1, 328) = 13.40, p < .001$). Higher AIAS scores were significantly associated with reduced preference for pedestrian-protective choices ($B = -0.37, 95\% \text{ CI } [-0.57, -0.17]$).

5.3 Effects of cultural orientation

The results revealed a significant main effect of Horizontal Collectivism ($F(1, 328) = 4.22, p = .041$) and a marginally significant main effect of Vertical Collectivism ($F(1, 328) = 3.20, p = .074$). Pairwise comparisons of the marginal means showed that pedestrian-protective choices were preferred significantly more by participants with high VC ($M = 0.87, SE = 0.14$) than by participants with low VC ($M = 0.49, SE = 0.14$), and significantly more by participants with high HC ($M = 0.88, SE = 0.15$) than by participants with low HC ($M = 0.47, SE = 0.13$).

The results also showed 2-way significant interactions between HI and the number of occupants ($F(2, 2640) = 5.48, p = .004$), between HI and the number of pedestrians ($F(2, 2640) = 3.59, p = .028$), and between VI and the number of pedestrians ($F(2, 2640) = 3.47, p = .031$). We examined these interactions testing the simple effects of HI and VI separately at the different levels of the number of pedestrians and occupants (averaging each time across the other factors). The results showed that only with 1 passenger in the car (averaging across the number of pedestrians, see Figure 2.B) participants with higher HI showed significantly less preference for pedestrian-protective choices ($M = 1.30, SE = 0.16$) than participants with low HI ($M = 1.73, SE = 0.14, z = -1.96, p = .049$). Also only with 5 pedestrians on the street (averaging the the number of passengers, see Figure 2.C), participants with higher HI tended to show less preference for pedestrian-protective choices ($M = 1.52, SE = 0.16$) than participants with low HI ($M = 1.91, SE = 0.14, z = -1.78, p = .074$), although the difference was only marginally significant.

We also used interaction contrasts comparing the linear and quadratic trends for the effect of the number of pedestrians/passengers

in participants with high vs low levels of HI and VI. The linear trend for the effect of the number of passengers was significantly lower in participants with high HI ($\Psi_{lin} = -1.56, SE = 0.1$) than in participants with low HI ($\Psi_{lin} = -2.03, SE = 0.09, \Delta = 0.48, z = 3.21, p < .001$), see Figure 2.B. The same was true for the linear trend for the effect of the number of pedestrians, which was significantly lower in participants with high HI ($\Psi_{lin} = 1.72, SE = 0.1$) than in participants with low HI ($\Psi_{lin} = 2.10, SE = 0.09, \Delta = -0.39, z = -2.68, p = .007$), see Figure 2.C. The linear trend for the effect of the number of pedestrians was however significantly higher in participants with high VI ($\Psi_{lin} = 2.1, SE = 0.11$) than in participants with low VI ($\Psi_{lin} = 1.72, SE = 0.09, \Delta = 0.38, z = -2.59, p = .009$), see Figure 2.D. The corresponding quadratic trends for the effect of the number of pedestrians and of passengers were all significant, but smaller than the linear trends, didn't increase fit to the data as measured by AIC, and they did not change significantly with the levels of HI and VI of participants.

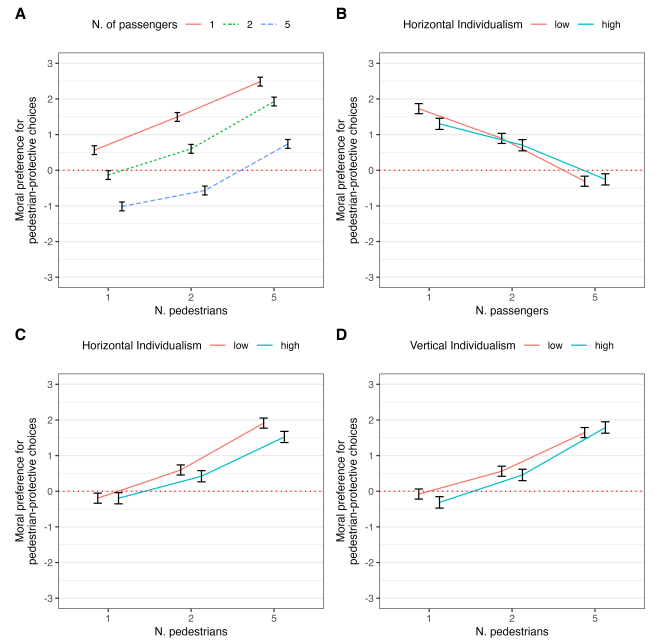


Figure 2: Marginal means of the preference for pedestrians-protective choices (over passengers-protective choices) made by an AV in moral dilemmas as a function of (A) number of passengers and number of pedestrians, (B) number of passengers and participants' level of Horizontal Individualism, (C) number of pedestrians and levels of Horizontal Individualism, and, (D) number of pedestrians and levels of Vertical Individualism. Error bars represent 95% confidence intervals for the means.

6 Discussion

We examined whether pedestrian-protective choices by AV in road situations involving moral dilemma are favoured over passenger-protective alternatives (RQ1), and whether preferences are affected

by cultural orientation (RQ2) of participants. Consistently with previous findings and in line with our first hypothesis (HP1) our results show a slight but significant overall preference for pedestrian-protective choices, similar to the pattern documented across prior studies [1, 28]. As expected, this preference was strongly affected by the number of people involved. We observed that increasing the number of pedestrians strengthened the preference for pedestrian-protective choices, while increasing the number of passengers reduced it. This pattern is consistent with the utilitarian logic described in prior work [5, 29], and confirms that participants are broadly sensitive to outcome-based reasoning even if their initial preferences do not always reflect it. At the same time, the overall preference for pedestrian-protective choices, while statistically reliable, remained modest in magnitude, consistent with our hypothesis and with the previously documented tension between utilitarian ideals and self-protective instincts in AV dilemmas [4, 12, 19].

In line with our second hypothesis (HP2), moral preferences vary with the cultural orientation of participants. We expected to find greater preference for pedestrian protective choices in participants from collectivist cultures than in participants from individualistic cultures, and we did find that having higher levels of horizontal (and marginally also vertical) collectivism slightly but significantly increases preference for pedestrian-protective choice.

We also found that participants with more positive attitudes towards AI, as measured by the AIAS-4, had reduced preference for pedestrian-protective AV choices. This finding aligns with the broader literature on acceptance of AVs: individuals may perceive AVs as tools that serve them if they are more positively disposed toward artificial intelligence. This leads individuals to prefer that AVs prioritize their own (passenger) safety [7, 12].

6.1 Limitations

The findings reported here should be interpreted in light of several limitations. First of all, we recruited participants from specific countries based on the VSM 2013 [17] in order to compare judgments in individualistic and collectivistic cultures, but we didn't find the expected differences in individualism and collectivism across countries and cultural samples. To test our hypotheses on the effects of cultural orientation we thus relied on individual cultural orientation measurements made with validated scales [38], but the lack of the expected cross-cultural differences might question the validity of our measurements and thus of our findings. Other studies, however, [22, 26, 41] also failed to find these differences, and interpreted this as a sign of ongoing trends in cultural change, with increasing individualism in collectivist countries [15] and increasing collectivism in Western cultures, possible due to economic development [40] and increased emphasis on teamwork and cooperation in organizational contexts [31].

A second limitation concerns the measurement. Participants in this study were asked to rate the moral acceptability of AV decisions rather than to make a direct choice between outcomes. One might wonder whether this distinction matters, whether people who say a pedestrian-protective choice is "very justifiable" would actually prefer that outcome if they were the passenger. We think this concern is less serious than it might appear. Liu et al. [24] have recently shown that moral norm judgments and direct choice preferences

tend to align closely in dilemmas of this kind, suggesting that our acceptability ratings are likely to reflect preferences that would generalize to more behaviorally direct measures.

Lastly, the scenarios used in this study are simplified in terms of design. Real road accidents occur in complex social, legal, and situational contexts that our vignettes necessarily abstract away from. We do not think this undermines the relevance of our findings, however. Gill [12] has shown that precisely these kinds of stylized ethical dilemmas are among the most prominent concerns shaping public attitudes toward AV adoption, and that they have tangible consequences for trust and purchase intention. The simplicity of the scenarios is therefore a feature as much as a limitation: it isolates the moral reasoning process of interest and allows for cleaner comparisons across conditions and cultures than more complex, realistic scenarios would permit.

7 Conclusion

This study set out to examine how people morally evaluate passenger-versus pedestrian-protective decisions made by AVs in unavoidable road accident scenarios, and whether these evaluations are shaped by cultural orientation. Across a sample of 346 participants recruited from four countries, we found a modest but reliable overall preference for pedestrian-protective choices, consistent with the utilitarian norm of minimizing casualties that has been documented across the AV ethics literature. This preference, however, was never absolute, it was pulled in different directions by the number of lives at stake and by individual cultural orientation. Participants with higher levels of horizontal and vertical collectivism showed a greater preference for pedestrian-protective outcomes, supporting the view that cultural orientation shapes moral judgment in AV dilemmas, even if its effects are more nuanced than a simple individualism–collectivism divide would predict. These findings suggest that AV technologies with different decision-making preferences may need to be designed depending on the cultural context in which they have to be used, to reflect cultural differences in moral expectations in passenger-pedestrian dilemmas and ultimately enhance public acceptance across cultures. However, this could be difficult to do given that, as our own study also shows, cultures change over time, and even established distinctions such as the one between individualistic and collectivistic countries might be less stable than it is commonly thought. Our further results about the association of positive attitudes toward AI with reduced preferences for pedestrian-protective choices, however, suggest that as AVs become more familiar and positively perceived by the general public, the moral expectations people bring to them may shift in a passenger-protective direction, independently of any deliberate moral programming. This dynamic deserves closer attention in future research, particularly as AV adoption increases and attitudes toward the technology evolve.

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