Various Vulnerabilities in Highway Hierarchies:

Applying the UK Highway Code's Hierarchy of Road Users to Autonomous Vehicle Decision-Making

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ABSTRACT

In 2022 the UK government introduced extensive updates to the Highway Code. This includes making specific reference to autonomous vehicles (AVs) on UK roads as a present reality, as well as providing a clear 'hierarchy of road users.' This order of road users is based on the code's understanding of their relative vulnerability and, therefore, their need for protection. In the context of AVs and crash scenarios, the subject of relative value among road users has arisen – often in the form of trolleyology. Considering the new code offers a simple approach to this question, with a clear hierarchy of users, it may be argued that the code goes some way to address the public's concern. This article explores the new code, its approach of using vulnerability to create a hierarchy of road users, and its implications for programming AVs in crash scenarios.

KEYWORDS

Ethics of Crash Scenarios, Hierarchy of Road Users, Highway Policy, Self-Driving Cars, Trolly Problems, UK Highway Code

INTRODUCTION

This article discusses the concerns of autonomous vehicles (AVs) and trolley problems in light of the new highway code introduced by the UK government in 2022. This code "is essential reading for all road users, including pedestrians, mobility scooter users, cyclists, horse riders, drivers and motorcyclists" (Department for Transport [DfT], 2022a). Two aspects of this new code interest us here. The first is its explicit "hierarchy of road users" (DfT, 2022a, p. 6). The old code implicitly affirmed a hierarchy by recognizing that the "most vulnerable road users are pedestrians, particularly children, older or disabled people, cyclists, motorcyclists and horse riders" (DfT, 2015).[1] Yet the new code explicitly clarifies and formalizes this hierarchy. In particular, the new hierarchy describes a

clear order of vulnerability and implicitly prioritizes certain classes of road users. Second, the new highway code is the first in the UK to refer to AVs as if they are already a present reality on UK roads. In this sense, the new highway code introduces a basic code of conduct by which AV operators, programmers, and developers must adhere when on public roads. This includes what operators can and cannot do in fully autonomous mode and how these cars should interact with other road users (such as pedestrians and cyclists).

Considering the extensive discussions on value hierarchies involving AVs and crash scenarios (Awad et al., 2018; Awad et al., 2019; Evans et al., 2020; Wang et al., 2023), the manner in which the highway code presents a hierarchy of road users is fascinating and begs the question of whether such a simplistic hierarchy of vulnerability and priority should be used to plan the motion of an AV in a crash scenario. This brief, hypothetical, and purely heuristic position paper explores some implications of applying the new highway code's hierarchy of vulnerability and priority to AV decisions in a crash scenario. It must be noted that the code does not thoroughly discuss the types of ethical standards that should be followed. Consequently, this paper is not an in-depth qualitative analysis of the underlying philosophy or preconceptions of the new highway code or algorithm ethics. These debates are extensive, with numerous researchers discussing the application of moral philosophical theories—such as utilitarianism, deontology, and other values—that might be integrated into AV decision matrix algorithms (Evans et al., 2020; Faulhaber et al., 2019; Geisslinger at al., 2023; Kumfer & Burgess, 2015; Lim & Taeihagh, 2019; Nyholm & Smids, 2016; Shah et al., 2021; Umbrello & Yampolskiy, 2022; Zhu et al., 2022). Nor does this paper present clear solutions to the highly complex problem of programming AVs in crash scenarios, which have plagued these debates for the last decade. Instead, we ask whether or not the implicit approach presented in the UK's new highway code (of identifying the vulnerable parties and giving them priority) offers a potential solution to the conundrum of planning decisions for AVs in crash scenarios. We merely consider one possible solution—a hierarchy of road users—that may be interpreted as arising from the new highway code.

With this in mind, we will begin this paper with a brief introduction to the new highway code, its hierarchy of road users, and various ethical issues worthy of independent consideration. Having done this, we will turn our attention to the issue at hand: self-driving cars in the new code, their position in the hierarchy, and a brief discussion on how to interpret the highway code's responses to common crash scenarios that have captured the public's attention.

THE (NOT-SO) NEW HIGHWAY CODE AND A HIERARCHY OF ROAD USERS

Building on the 2015 version, the 2022 UK Highway Code explicitly prioritizes various road users. While the previous code mentions the most vulnerable road users without determining who should be most protected, the 2022 code presents a clear approach to the question of who is most vulnerable and, therefore, should be most protected. Its approach to who has priority is based on who is "most at risk" (DfT, 2022a, p. 130) and, consequently, who has right of way in certain circumstances (such as intersections). While a number of other road users are mentioned (such as trams), broadly speaking (and in order of vulnerability/priority), the code mentions pedestrians, cyclists, equestrian-related users (horse riders/horse-drawn vehicles), motorcycles, cars, and larger vehicles (such as trucks, vans, and minibuses).

The code argues that not all road users are equally vulnerable to injury or death in a collision: "The road users most at risk from road traffic are pedestrians, in particular children, older adults and disabled people, cyclists, horse riders and motorcyclists. It is particularly important to be aware of children, older adults and disabled people" (DfT, 2022a, p. 130). Implicitly, these users have the right of way in most circumstances simply because of their explicitly stated vulnerability. Cars, conversely, are given lower priority (second only to larger vehicles such as trucks).

The code explicitly states that while all road users "share" (DfT, 2022a, p. 4) responsibility, it implies that those at the bottom of the vulnerability rung (i.e., those least vulnerable) have the greatest

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