Institute of Cognitive Science_____

University of Osnabrueck   D-49069 Osnabrueck

Prof. Dr. Gordon Pipa
- Neuroinformatics -

Universität Osnabrück
Albrechtstraße 28
49076 Osnabrück

Tel.:   +49 (0)541 969-2277
Fax.:   +49 (0)541 969-2246
e-mail: gpipa@uos.de

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Hardware Grant Request: Proposal

Project title: Empirical assessment of human ethics in virtual reality

Team Leader: Gordon Pipa, University of Osnabrueck

Introduction

While autonomous vehicles (AVs) are expected to increase road safety, accidents caused by other road users, mechanical or software failures, or unforeseeable conditions like ice or oil on road will continue to happen. Ethical considerations will often come into play, e.g. when deciding which object to collide with in case of an unavoidable collision. Acceptable levels of risk will have to be determined in various situations, for instance whether or not a biker should be passed on a narrow road or if an ambulance should drive through a red light. So far however, neither of the two principal philosophical directions - utilitarianism and deontologism - can offer solutions that agree with our moral intuition in all possible cases. The ethics implemented in AVs are therefore likely to rely on empirical assessment, and may in many instances entail value-of-life (VoL) metrics. It is yet unclear, how to best assess these metrics empirically, and in what way the formulation of the problem may influence the final outcome. It also needs to be addressed to what extent an algorithm should be held to the same standards as a human when it comes to moral judgment calls.

Our primary goal is to find, whether or not the use of virtual reality can be a better environment to empirically assess human ethics than traditional methods such as language-based surveys.

Furthermore, we will evaluate in what way the acceptability of ethical decisions change, when a car is controlled by a computer instead of a human driver.

Methods

We are going to conduct a series of experiments, in which participants will be placed in a virtual reality environment where they control a car in a forced choice paradigm based on the trolley problem. In

each of several trials they will be presented two obstacles from the categories humans, animals, and inanimate objects. The choice will be, which object to save and which to collide with. In the first study, decisions in an immersive, naturalistic 3D setting will be compared to those from an abstract, purely word-based condition resembling a questionnaire. In a second segment we will assess the acceptance of ethical decisions of the aforementioned kind, depending on whether they were said to be computer-generated or man-made. These exemplary decisions will again be presented in the naturalistic virtual reality setting.

The study design thus relies heavily on a maximum of immersion, which we will achieve by utilizing the Unity 5 game engine in combination with the Oculus Rift DK2. Detailed graphics and rendering of high resolution stereoscopic images with the imperative of achieving a constant frame rate of 75 fps requires considerable GPU performance.

Outlook
After the first study is completed, a series of follow-up studies is planned, employing the virtual reality environment to build upon the first study and gain a more detailed insight into human ethics. Based on the results of the initial study, these are planned to investigate the extent, to which utilitarian and deontological considerations are implicitly used in our moral judgment and how much the drive for self-preservation and the concept of fairness come into play. To maximize immersion, this series of follow-up studies we will likely use the latest generation of HMDs, namely the Oculus Rift (consumer version) and/ or HTC Vive, both of which come with even higher demands in terms of resolution, frame rate and therefore GPU performance, requiring us to upgrade our VR workstation.

Sincerely, Gordon Pipa