

Human factors aspects on joystick control of adapted vehicles

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Abstract

An experiment was set-up to investigate different joystick designs based on steer-by-wire technology. The experiment was carried out in a driving simulator. Both driving behaviour and perceived control of the car was registered and analysed. All participants had a SCI (Spinal Cord Injury) at cervical level, i.e. drivers with tetraplegia. Two types of joysticks were tested, one conventional (similar to what is used with computer games) and one modified with which the driver could control speed and steering independently. Both joysticks were tested with and without active feedback. The driving task consisted of rural road driving and a manoeuvre test with a double lane-change.

The results presented here should be considered as preliminary and the study as a pilot study, which will be completed with a larger set of participants. So far 8 subjects have completed the experiment. The preliminary results cannot be used to draw any definite conclusion on which system design should be preferred. There was some evidence that active feedback provided a better lateral control and the drivers drove with larger safety margins with the modified joystick. However, the drivers' opinion seemed to be more in favour of the conventional passive joystick.

Introduction and background

The ordinary primary driving controls in a standard production car, i.e. steering wheel, accelerator and brake pedals, provide feedback to the driver and utilise a rational control distribution on the driver's hands and feet. However, drivers with so severe disabilities that they cannot drive a conventional car could benefit from an alternative design of the primary controls. The emerging steer-by-wire technology will enhance the freedom to design a more accessible environment for drivers with disabilities. However, the replacement of conventional controls with steer-by-wire controls should be made in a way that the driver has equal or better control of the car compared with drivers of conventional cars.

In D. de Waard, K.A. Brookhuis, J. Moraal, and A. Toffetti (2002), *Human Factors in Transportation, Communication, Health, and the Workplace* (pp. 81 - 112). Maastricht, the Netherlands: Shaker.