Joystick versus conventional driving controls

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Abstract

Joystick controlled vehicles for disabled drivers are not common. Since a joystick differs fundamentally from conventional primary controls, studying joystick control can reveal several critical issues concerning alternative primary controls and drive-by-wire technology. A joystick combines steering and speed control in one single lever. In a manoeuvre test with joystick-controlled cars, interference between steering and speed control and difficulties in performing fast and accurate steering were observed.

Background

Electronic components have the potential of replacing mechanic/hydraulic components of the primary control systems of the car. The use of electronic components allows for flexible control design and placement. For over a decade, joystick controlled cars have been a reality for drivers with disabilities (Östlund, 1999). Car adaptation companies are to some extent aware of potential risks and deficiencies with current joystick-controlled cars. A joystick can be difficult to handle and is therefore considered a last adaptation alternative. In December 1998, a manoeuvre test was conducted to study the Human Factors aspects of joystick control for drivers with disabilities (Östlund & Peters, 1999). This study was the first to focus on joystick-controlled cars for drivers with disabilities.

Joystick design and control-characteristics

The joystick is used to control speed and steering. The joystick car drivers mostly lack strength and hand mobility, and for that reason the joystick is small and mainly controlled by small finger movements and hand rotations. The joystick angular range of motion is 1/30 of that of the steering wheel. The obviously resulting precision/range problem is commonly solved by a speed-dependent downscaling and filtering of steering commands. The filtering and system limitations result in time lags. As a consequence, it may be difficult to perform very fast and large steering manoeuvres, and there is not a correspondence between joystick and steering wheel at all times.

In D. de Waard, K.A. Brookhuis, J. Moraal, and A. Toffetti (2002), *Human Factors in Transportation, Communication, Health, and the Workplace* (pp. 77 - 81). Maastricht, the Netherlands: Shaker.