Design of an Agricultural Driving Simulator for Ergonomic Evaluation of Guidance Displays

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Agricultural guidance systems have changed significantly over a short period of time. Only a decade ago, there were no sophisticated navigation systems available commercially. During the past decade, there has been a rapid influx of ideas based on global positioning system (GPS) technology, beginning with 'lightbar' navigation aids (that presented supplemental navigation information for the driver) and now auto-steer systems (that make steering corrections for the driver). This rapid change in technology has significantly changed the role to be played by the human operator of the agricultural vehicle. Human factors principles are needed to understand how best to utilize the capabilities of the human operator in these new human-machine systems. This paper describes the development of a driving simulator that models the tasks of operating an agricultural vehicle. The two fundamental tasks include steering (i.e., guiding the vehicle) and monitoring of the implement behind the vehicle. Information is provided to the operator through visual, vestibular, proprioceptive, haptic, and auditory cues. The operator can be observed using performance, physiological, and subjective measures. In previous decades, agricultural engineers have been successful in reducing the physical workload associated with agriculture. It is anticipated that the driving simulator can be an effective tool for researching (and reducing) the mental workload associated with operating increasingly-sophisticated agricultural machines.