Research Report Summary

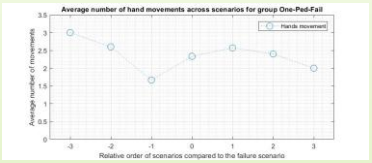
Dr. Michael Knodler Jr., PhD 11/8/2018

To Trust or Not to Trust? A Simulation-based Experimental Paradigm

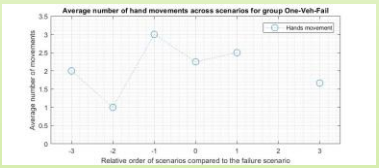
Advancements in technology have been leading to the automation of manual tasks in different fields, including manufacturing, aviation, maritime operations, and most recently the vehicle industry. Because of the varying definitions of automation across disciplines, the definition used in this study is based on the work of Parasuraman et al. [3], which defines automation as the execution of one or multiple functions that were previously carried out by a human operator [1,2]. The main objective of this study was to gain better insight into the impact of one's trust in the automated system. More specifically, this study considers the effect of system failure on subjects' trust in the system when driving with an automated vehicle. A total of 80 subjects aged 20-30 years participated in this study. All participants were recruited from the University of Massachusetts Amherst and surrounding area and were compensated for their time. All participants had a U.S. driving

Sample driver interaction scenarios: pedestrian (top) and intersection (bottom)

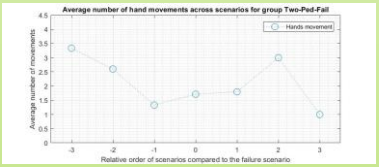
Average Number of Hand Movements across Scenarios



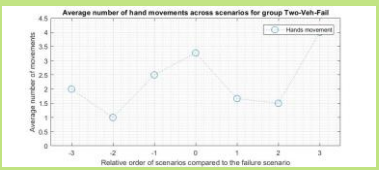
Average number of hand movements across relative sequences of scenarios for the group with one pedestrian failure



Average number of movements across relative sequences of scenarios for the group with one vehicle failure



Average number of hand movements across relative sequences of scenarios for the group with two pedestrian failures



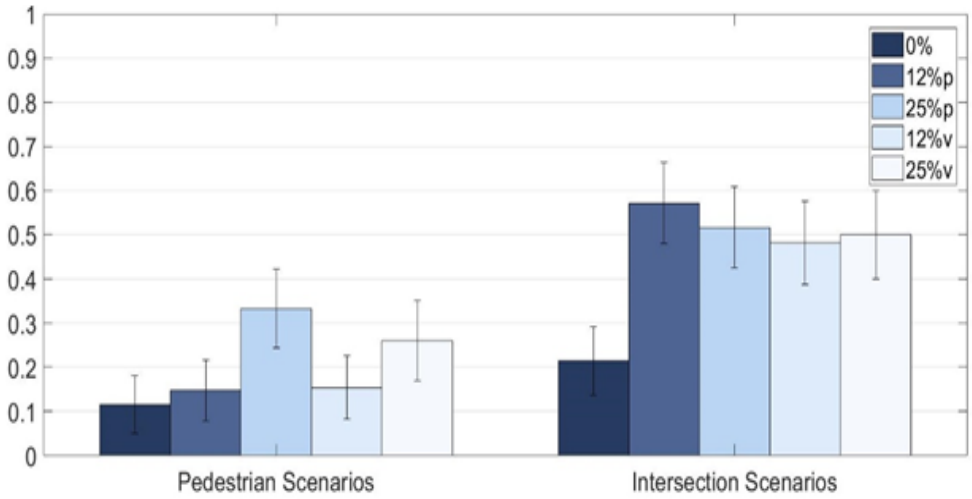
Average number of hand movements across relative sequences of scenarios for the group with two vehicle failure

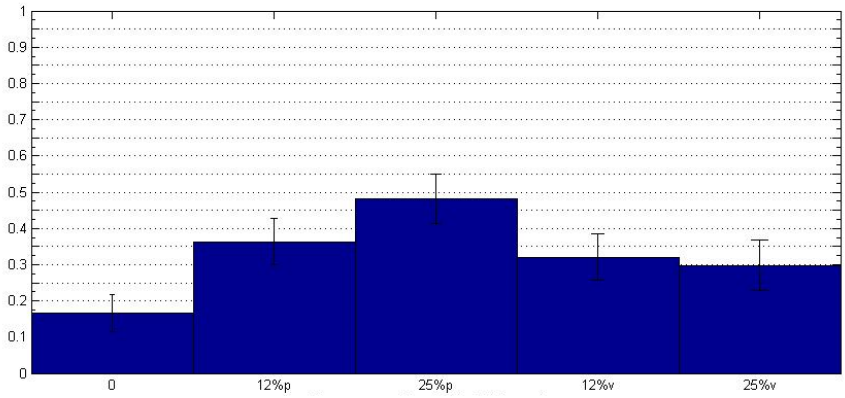
license and a minimum of two years driving experience.

Participants were pseudo-randomly assigned to one of the five groups that interact with an automated system that was either 100% reliable, 88% reliable with pedestrian or stop control failure, or 75% reliable with pedestrian or stop control failure. The 100%, 88%, and 75% reliability levels had 0, 1, or 2 failures, respectively, out of the total of eight scenarios.

A look at the automation usage showed that drivers who experienced any level or type of system failure were more likely to disengage automated systems in situations where the system was appropriately responding to the environment. In other words, any type or level of system failure that was introduced in this study significantly increased the probability of unnecessary disengagement when the system's response was appropriate.

The figures below represent the disengagement rates across the different types of failure (top) and the disengagement rates for no-fail scenarios (bottom).





References

1. Lee, J.D., See, K.A., 2004. Trust in automation: Designing for appropriate reliance. Human Factors: The Journal of the Human Factors and Ergonomics Society 46 (1), 50-80.
2. Parasuraman, R., Riley, V., 1997. Humans and automation: Use, misuse, disuse, abuse. Human Factors: The Journal of the Human Factors and Ergonomics Society 39 (2), 230-253.
3. Parasuraman, R., Sheridan, T.B., Wickens, C.D., 2000. A model for types and levels of human interaction with automation. IEEE Transactions on systems, man, and cybernetics-Part A: Systems and Humans 30 (3), 286-297.