Chapter 45
Two Routes to Trust Calibration:
Effects of Reliability and Brand Information on Trust in Automation

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ABSTRACT

Trust calibration takes place prior to and during system interaction along the available information. In an online study N = 519 participants were introduced to a conditionally automated driving (CAD) system and received different a priori information about the automation's reliability (low vs high) and brand of the CAD system (below average vs average vs above average reputation). Trust was measured three times during the study. Additionally, need for cognition (NFC) and other personality traits were assessed. Both heuristic brand information and reliability information influenced trust in automation. In line with the Elaboration Likelihood Model (ELM), participants with high NFC relied on the reliability information more than those with lower NFC. In terms of personality traits, materialism, the regulatory focus and the perfect automation scheme predicted trust in automation. These findings show that a priori information can influence a driver's trust in CAD and that such information is interpreted individually.

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INTRODUCTION

The complex interaction pattern in CAD at level 3 automation as defined by the Society of Automotive Engineers (SAE) in the SAE J3016R technical report (SAE, 2016) requires an elaborate design of the user interface to guarantee efficient and comfortable coordination of driving tasks between driver and automation. In this regard psychological concepts like an appropriate level of trust support a human-centred design of interaction concepts. Trust in automation has been found to play a particularly important role in the decision if and how drivers use automated systems (e.g. Hoff & Bashir, 2015). Thus, the nature of trust formation holds important implications for the design of safe, acceptable and efficient driving automation (e.g. Walch et al., 2017). Among others, the information about the automated system available to the driver before the first system use may determine if the system is used despite initial suspicion. To overcome this obstacle – and at the same time preventing an overly optimistic impression of the automation - the information provided prior to actual use has to be designed in a way that a general positive attitude towards the automation is generated while at the same time an appropriate understanding about its actual capabilities and limitations is facilitated. As a consequence, an important challenge for designing safe and efficient CAD systems is it to increase the knowledge of what kind of information drivers use for trust calibration under which conditions.

At this point, little research has been conducted on the mechanisms of trust formation and the nature and timing of information fostering an adequate mental model and efficient trust calibration (Lee & See, 2004; Kraus, Scholz, Stiegemeier, & Baumann, 2018). Also, the contextual factors playing a role in this process have not been investigated to a sufficient degree. The current study provides an investigation of the effects of information on a priori trust levels towards automated driving. On the theoretical basis of the Elaboration Likelihood Model (ELM) (Petty & Cacioppo, 1986) two types of a priori information (OEM brand information and reliability information) were manipulated in an online experiment. Based on a cluster analysis, six OEM brands were grouped in three brand reputation groups (below average/ average/above average) and as a manipulation for system reliability, participants read one-pagers, in which the results of an imaginary function test were reported (low vs high reliability). Additionally, several personality traits that are hypothesized to influence the first impression of an automated vehicle were investigated. Furthermore, the role of need for cognition (NFC) (Cacioppo, Petty, Kao, & Rodriguez, 1986) in the utilization of different types of information was investigated.

THEORETICAL BACKGROUND

Trust in Automation

Trust in automation is defined as "[…] the attitude that an agent will help achieve an individual's goals in a situation characterized by uncertainty and vulnerability" (Lee & See, 2004, p. 51). With the increasing complexity of driving automation and the dynamic character of the driving task, for users, a thorough understanding of its functional scope and its operation sequence becomes more and more difficult. Consequently, trust in automation gains importance for the decision to use or not use an automation (e.g. Lee & See, 2004) and thus it is crucial that users' trust is calibrated in line with a system's actual capabilities and performance (Muir, 1987). An appropriate level of trust is the key to a balanced and safe usage of driving automation and an essential goal for the design of interaction concepts for driving automation.

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