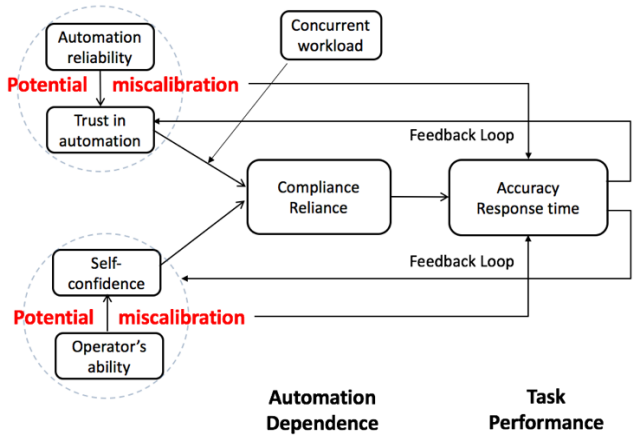
Human-automation interaction: Going beyond trust

The use of automation to assist human performance is growing at an unprecedented pace. As the capabilities of the automation advance, there is an increasing possibility that it might function as a full-fledged team member (Parasuraman, Sheridan, & Wickens, 2000). Ideally, human-automation teams should result in performance gains. However, such teams oftentimes fail to deliver the promised benefits, one of the major reasons being the human operator's inappropriate dependence on automation (Parasuraman & Riley, 1997).

In the past two decades, trust has been recognized as the central influence on automation dependence (Wickens et al., 2013). The miscalibration between human operators' trust in automation and automation's true reliability has received substantial amount of research. Inappropriate automation dependence as a consequence of overtrust or undertrust has been well documented (Hancock et al., 2011, Hoff & Bashir, 2015, Lee & See, 2004).

We argue that trust is not the entire story, for one needs to consider the human operators' ability of performing a task manually. We propose an integrative model to examine human-automation interaction by incorporating two types of potential miscalibrations, one between trust and automation reliability, and the other between a human operator's self-confidence and his or her actual ability.



To validate the model, we conducted a human subject experiment. In the experiment, 67 participants completed a forced-choice recognition task, with the assistance of a fictional automated decision aid of varying reliability. Trust was measured using a Likert scale and automation dependence was measured by the extent to which participants changed their recognition choices after receiving recommendations from the automated decision aid.

We found that operators' self-confidence, compared to trust, is a stronger and more stable predictor of automation dependence. Moreover, when automation advice is of positive expected utility, human operators' overconfidence bias leads to inappropriate rejection of reliable automation advice and harms human-automation team performance. Conversely, when automation advice is of negative expected utility, overtrust results in inappropriate acceptance of unreliable automation advice and impairs human-automation team performance. The experimental results showed that human operators' confidence-ability miscalibration is as important as, if not more important than trust-reliability miscalibration.

This model elucidates the underlying reasons for inappropriate automation dependence. It can be applied to a wide variety of scenarios, including automated combat identification (CID), automated threat detection (ATD) at security screening and computer aided diagnosis (CAD) in healthcare.