

The effects of Adaptive Automation on pilots' flight control performance and visual attention distribution

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Abstract. Adaptive automation, the scheme to allocate power of control between the automation system and the human operator dynamically and flexibly depending on situations, has been studied in multiple disciplines recently. It is expected to alleviate the Out-Of-The-Loop (OOTL) phenomenon of human operators through occasional handover. However, the effectiveness and impacts of adaptive automation on human pilots in aviation scenarios are still unrevealed. To partially fill this gap, this study will investigate how the preset handover affects pilots' emergency-handling performance and psychophysiological alteration. The emergency-handling performance will be measured by the aircraft control behaviours recorded by the flight simulator, and the psychophysiological alteration will be assessed based on eye movements recorded by the eye-tracker. Twenty-six student pilots were recruited to participate in a comparative experiment consisting of two simulation flight tasks in a flight simulator. Compared with the control flight which performs autopilot during the whole cruising phase, the adaptive automation mode requires the pilots to conduct twice manual piloting at preset time points. Finally, an identical engine shutdown is triggered in each flight to assess the pilots' emergency-handling performance. As a result, the aircraft control behaviours data of the adaptive automation mode demonstrates a significant superiority and the eye movements data also presents several indicative divergences. This study reveals the natural human responses to the handover between autopilots and human pilots. The results can serve as a foundation for further developing the autopilot into the adaptive automation paradigm.

Keywords. Adaptive automation, flight safety, pilot performance, visual behaviours

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