

INSPECT: Understanding Trainee Cognitive Processes in ATC Training

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ABSTRACT

In the highly demanding field of air traffic control (ATC), where complex skills and extensive workload management are required, it is essential to have insight into the cognitive processes of trainees in order to facilitate effective training. Performance-based training (PBT) has readily been employed in recent years to train air traffic controllers (ATCOs) on technical and procedural skills, such as adherence to communication protocols and separation procedures; however, while software tools has been developed for PBT to support the assessment of technical skills, obtaining insights into non-technical (cognitive) abilities, such as information perception and workload management, has proven more challenging.

In this paper, we present INSPECT – a technology demonstrator with the aim of supporting instructors in coaching of non-technical competencies by providing objective insights into the cognitive processes of trainees. Our approach involves the use of eye tracking to relate the eye movements and pupil dilation of the trainee to the information presented on the trainee's radar screen, enabling our software to derive a range of objective metrics, covering three major cognitive skills: situational assessment, workload management, and problem solving/decision-making. By leveraging data obtained from eye tracking and the flight data presented on the radar display, INSPECT is able to derive a range of objective metrics, concerning the perception of information, anticipation of inbound flights, mental workload, visual scanning cycle, and decision-making; results are then displayed in a user-friendly dashboard for the purpose of debriefing. What's more, to support the instructor during a training session, a live tool is developed to display the trainee's real-time eye movements on the radar screen, allowing the instructor to follow the scanning cycle of the trainee. Ultimately, our research demonstrates the potential of instructor support tools to transform data to insights, thereby enhancing the effectiveness of ATCO training.