Examine the relationship between expertise, performance, and gaze behavior

PLOS One

Stephanie Brams[1], Ignace Hooge[2], Gal Ziv[3], Siska Dauwe[1], Ken Evens[4], Tony De Wolf[4], Oron Levin[1], Johan Wagemans[5], Werner F Helsen[1]

[1]Movement Control & Neuroplasticity Research Group, Department of Kinesiology, KU Leuven, Leuven, Belgium, [2]Experimental Psychology, Department of Psychology, Helmholtz Instituut, Utrecht University, Utrecht, The Netherlands, [3]The Academic College at Wingate, Wingate institute, Netanya, Israel, [4]CAE Oxford Aviation Academy, Brussels, Belgium, [5]Laboratory of Experimental Psychology, Department of Brain & Cognition, KU Leuven, Leuven, Belgium

dx.doi.org/10.17504/protocols.io.sk3ecyn

Stephanie Brams

ABSTRACT

To examine the relationship between expertise, performance, and gaze behavior, eye-tracking was conducted while pilots (n = 24) and non-pilots (n = 26) completed a complex error-detection cockpit task. During this task, video-clips from a pilot's viewpoint were shown and the participants were asked to detect malfunctions in the cockpit instrument panel. Statistics of eye-tracking results were processed in SPSSStatistics app using two-way repeated measures ANOVA analyses, with AOI as repeated measures factor and independent T-tests. Furthermore, a special measure was calculated to assess scan pattern systematicity differences between pilots and non-pilots, the scan entropy value. Beside, performance on a specific expertise-domain related task, the error-detection cockpit task, generic tasks (Navon Level-Switching task and Coherent Motion task) assessing attentional generic skills were completed by all participants. Outcome scores of generic tasks were analyzed using independent T-tests and a stepwise regression analysis was conducted to assess which generic skill might be related to the specific skill of detecting errors in a cockpit display accurately.

EXTERNAL LINK

https://doi.org/10.1371/journal.pone.0207439

THIS PROTOCOL ACCOMPANIES THE FOLLOWING PUBLICATION

Brams S, Hooge ITC, Ziv G, Dauwe S, Evens K, Wolf TD, Levin O, Wagemans J, Helsen WF (2018) Does effective gaze behavior lead to enhanced performance in a complex error-detection cockpit task?. PLoS ONE 13(11): e0207439. doi: 10.1371/journal.pone.0207439

PROTOCOL STATUS

Working

SAFETY WARNINGS

PLEASE DO NOT SHARE ANY IDENTIFIABLE DATA

BEFORE STARTING

It is important to restrict head movements to the minimum during the collection of eye-tracking measures, so make sure the participant is comfortable before starting any callibration.
Make sure no reflecting items like mirrors are present in the testing room as well as sun light.
Place the eye-tracker in front of the wall so the participant wont be distracted and fixate on elements behind the eye-tracker.

1 The error-detection cockpit task (1st day): Participant scores on the RPE Borg scale his or her rate of perceived exertion at that moment.

2 The participant receives instructions about the error-detection cockpit task: Monitor the instruments of the cockpit and click with the computer mouse on the instrument that shows an error. Sometimes the cockpit functions correct, and in this case, there does not need to be clicked. After each clip a multiple-choice question "I did not click because" needs to be answered. In case the participant did click (because an instrument was failing according to him or her), "non-applicable" can be chosen as answer for the multiple-choice question.

Correct functioning cockpit video clips can be identified with this multiple-choice question as "no error". The participant can also answer "because I was too late" or "because I have no idea" on this multiple-choice question. In case, the participant was too late to click on the failing instrument, the answer can be provided verbally and written down by the researcher.

3 Participant is seated in front of the Tobii T120 eye-tracker at a distance of approximately 60 cm.

4 Instruction video (10 minutes) containing a detailed explanation of the different cockpit-instruments is shown to the participant.

5 The eye-tracker is calibrated and the participant is instructed to restrict the head movements to the absolute minimum.

6 16 video clips of the cockpit (filmed during the day) in which occasionally one of the instruments will stop working are shown. In some video clips the cockpit just functions correctly.

7 At the end of the first day the participant indicates an RPE score again.

8 The generic tasks (2nd day): Participant receives instructions about the Coherent Motion task: Detect the direction of coherent moving dots between 600 random moving dots. Indicate this direction as accurate as possible with the errors on the keyboard. The trial starts with 25 practice trials and the fixation cross on the middle of the screen provides feedback (turns green in case of a correct answer and red in case of an incorrect answer).

9 After the practice trials, 200 experimental trials are completed.

10 Participant receives instructions about the Navon Level-Switching task: A white figure (global level) is shown on a black background drawn by smaller figures (local level) instead of a line. Detect squares or circles both at global or local level by pressing F on the keyboard as fast and accurate as possible when a square was observed and J on the keyboard as fast and accurate as possible when a circle was detected. First 20 practice trials appear, followed immediately by the actual test trials (n = 64).