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SHORT COMMUNICATION

VISUAL ATTENTION DISTRIBUTION AND RATE OF VISUAL INFORMATION ACQUISITION IN HUMAN CENTRIFUGE UNDER +GZ ACCELERATION

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Background: This article presents preliminary results of an assessment of pilots visual performance. The study group consisted of three young and inexperienced pilots. The SMI Eye Tracking Glasses were used to assess the visual attention distribution and the rate of visual information acquisition. The data were gathered in a human centrifuge under +Gz acceleration.

Keywords: eye tracking, human centrifuge, pilots, vision

Figures: 3 • **References:** 4 • **Full-text PDF:** http://www.pjamp.com • **Copyright** © 2015 Polish Aviation Medicine Society, ul. Krasińskiego 54/56, 01-755 Warsaw, license WIML • **Indexation:** Index Copernicus, Polish Ministry of Science and Higher Education

INTRODUCTION

During the initial period of pilots' training, comprehensive knowledge of the distribution of attention and gaze is crucial as it can be used to improve the efficiency and quality of training [1]. There is no better way to precisely assess instantaneous gaze fixation than by using eye tracking methods. The information on what a trainee is seeing at a given moment is invaluable for the instructor [2]. Using eye tracking during training can help to correct errors of attention distribution almost immediately. Nowadays, eye tracking methods are becoming more and more recognized. However, they are not widely applied in aviation for either training or evaluation purposes [3].

METHODS

Our study group consisted of three young and inexperienced pilots. We used the SMI Eye Tracking Glasses to assess the visual attention distribution and the rate of visual information acquisition in the human centrifuge under +Gz acceleration [4]. Basic data provided by the eye tracker are: saccades and fixations with their respective properties such as length and duration. Fig 1. depicts data gathered during a video presentation following the application of a 3-second delay filter in data fading in order to give the viewer a better understanding of the gaze path. The lines represent saccades with duration of a saccade corresponding to the length of a given line. The circles represent fixations and the size of the circle depicts duration of fixation. Our experiments were conducted in the human centrifuge, also used as a flight simulator, using the F-16 aircraft cockpit. We recorded the whole flight using eye tracking glasses. After determining and selecting the key moments of the flight, we measured and compared the number of fixations, saccades, and their mean duration. After analyzing all the elements of the +Gz flight, we compared these results with the elements obtained without a +Gz acceleration in order to assess if there were any differences in gaze features dependent on the acceleration status.

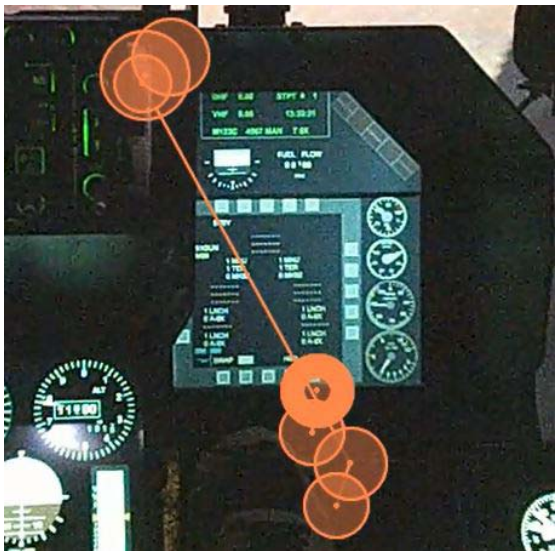

Fig. 1. Properties of saccades and fixations.

RESULTS

The eye tracking glasses equipment used gave us a possibility to present recorded data in two ways - as a video material with overlaid gaze properties and as numerical data suitable for statistical analysis. Having evaluated both the videos and numerical data, we discerned some patterns. First, when assessing the video material it could be observed that the area of visual control decreased during acceleration. Properties of saccades and fixations during a +GZ flight were sensitive to acceleration and changed in comparison to the zero G flight. Saccades were significantly shorter ($p=0.0399$) and fixations longer compared to the flight without any acceleration; however, this difference was not significant.

CONCLUSION

Eye tracking equipment gives a unique opportunity for both researchers and instructors. Thanks to such an elegant and efficient method of measuring pilots' visual performance, young pilots can perform better in training and later on duty. Knowing what to expect under acceleration makes the assessment of pilots' visual performance easier and more accurate. This research was supported by the Military Health Service Inspectorate as part of the research and development project 01/Wnil/2007, and was carried out during standard training procedures. The outcomes were presented during the 63rd International Congress of Aviation Medicine in Oxford.

Fig. 2. Pilot gaze properties without acceleration.

Fig. 3. Pilot gaze properties under +Gz acceleration.

AUTHORS' DECLARATION:

Study Design: Krzysztof Kowalczuk, Michał Janewicz, Marcin Strojek; **Data Collection:** Krzysztof Kowalczuk, Michał Janewicz, Marcin Strojek; **Statistical Analysis**: Krzysztof Kowalczuk, Michał Janewicz, Marcin Strojek; **Manuscript Preparation:** Krzysztof Kowalczuk, Michał Janewicz, Marcin Strojek; **Funds Collection:** Krzysztof Kowalczuk, Michał Janewicz, Marcin Strojek. The Authors declare that there is no conflict of interest.

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