The use and limits of eye-tracking in high-fidelity clinical scenarios: A pilot study

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ABSTRACT

Aim: To explore the potential of mobile eye-tracking to identify healthcare students' area of visual interest and its relationship to performance ratings.
Background: Eye-tracking identifies an individual's visual attention focus, and has been used as a training technique in medicine and in nursing. In this study participants wore a point of view (PoV) camera within a spectacle frame during simulation education experiences.
Methods: Thirty-nine final year nursing and paramedicine students individually participated in three 8 minute clinical simulations with debriefing using videoed eye-tracking recordings. Coloured dots on the video depicted the participant's pupil fixation on five targeted areas. Data extracted from the video camera were collated to report time spent on each target (their 'gaze').
Results: The mean total gaze of expert designated targets in the environment for three 8 minute scenarios was 40–77%. Of 35 participants' focus on three main areas of interest, their priority was the patient's head (34%), the patient's trunk (24%) and their clinical assistant (5%), with significant differences between nursing and paramedic disciplines ($P < 0.05$). Objectively rated clinical performance improved significantly by the third scenario ($P \leq 0.001$). Participants were positive regarding use of eye tracking during debriefing.
Conclusions: Eye tracking has the potential to enhance debriefing and educational outcomes, although there are limitations to gaze capture in high fidelity environments and resource cost is high. Further study is warranted to enable better understanding of how expert clinicians achieve high levels of performance.
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1. Introduction

Eye movement tracking or eye-tracking is a technology that has emerged from the field of marketing, whilst more recently being trialled as a technique for the training of healthcare professionals. Eye-tracking can identify the focus of an individual's attention and

measure eye movements based on where their pupil is focused (Poole and Ball, 2004). These measurements have been used in conjunction with other training assessments to examine how well clinicians perform procedures (Hermens et al., 2013; Poole and Ball, 2004). Some examples include investigation of nurses' scanning patterns during medication administration (Ze, 2011); the use of eye-tracking to explore patient identification errors in nursing (Henneman et al., 2010); and examination of electrocardiograph interpretation by novice expert and nurses (Horsley et al., 2014).

We hypothesised that recording performance whilst wearing a point of view (PoV) camera within a spectacle frame during simulation education experiences would enhance debriefing for health professional students. Eye-tracking recordings may further enable detailed analysis of the student's area of attention, inform their reflective review and, ultimately, assist decision-making and enhance performance (Box 1).
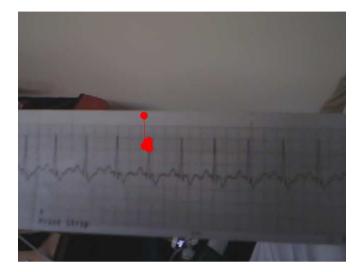

Fig. 3. The eye tracking video output. Note the pupil tracking (red) overlaid with the PoV capture.

Fig. 1. The Tobii eye tracking headset worn by participants.

Fig. 2. The eye tracking video output. Note the pupil tracking (red) overlaid with the PoV capture.

1.1. Eye-tracking technology

As humans, we make between three and five eye movements per second to examine and make sense of visual information (Holmqvist et al., 2011). Visual attention is the first step in making sense of complex information (Horsley et al., 2014). In clinical nursing, individuals need to collect and prioritise patient cues and make decisions about patient management using visual cues (Levett-Jones et al., 2010). Video technology incorporated into a pair of high-technology glasses and computerised software developed by Tobii Technology (Fig. 1) enables timed data replay. The Glasses capture PoV video and the pupil movement is mapped over this (Figs 2 and 3). With the assumption that gaze fixation is normally the focus of thought (Duchowski, 2007), it follows that eye-tracking could substantiate the timing and sequence of clinical decision-making during a simulation experience.

2. Methods

A pilot observational study was designed to explore the feasibility of using eye-tracking during high fidelity clinical simulation scenarios and the impact on students' learning experience. The objective was to identify undergraduate healthcare students' area of visual interest and its relationship to performance ratings.

2.1. Sample

A convenience sample of 39 final year undergraduate degree students was recruited from three Australian universities in 2013. The universities were chosen in order to recruit a sample of students studying in two disciplines and from two Australian states. Nineteen participants were enrolled in a Paramedic Bachelor programme and 20 in a Nursing Bachelor programme. Ethical approval was ob-