The Expert Eye

Testing the observational skills of Scene of Crime Officers using Eye Tracking Equipment.

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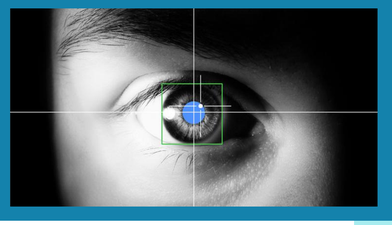

Aim and Objective

Aim
The aim of this experiment was to act as a pilot study when testing the observational skills of trained Scene of Crime Officers, examining a disaster scene using the eye tracking equipment Eyelink Mount desktop 1000, (Support Research, 2014).
Objective
This aim has been fulfilled, firstly, by creating a mock disaster scene of an airplane crash on the campus car park to collect a variety of photographs and video footage. The photographs were then sieved to find five final images, to become part of a stimulus used on the eye tracking device. The device used for this particular experiment was the Eyelink 1000 mount desktop, which allowed the eye movement of an individual to be analysed using a data viewer.

Null Hypothesis: The expert will NOT complete the experiment more efficiently than the novices.

Alternative Hypothesis: The expert WILL complete the experiment more efficiently than the novices.

Abstract

Disaster environments are complex and difficult environments to work within as there may be numerous personnel present concurrently and the damage can be catastrophic and widespread. Understanding how experienced personnel view and evaluate such scenes can help in devising training strategies for inexperienced colleagues at disasters. Those personnel attending such scenes must be able to efficiently identify the key pieces of evidence. The 'Eyelink 1000 mount desktop'™ allows the participant to view a digital stimulus such as a photograph or video on a computer screen, whilst allowing researchers to analyse the eye movement of the participant. Scene of Crime Officers (SOCO's) have undergone this eye tracking process to help observe, interpret and understand their observational skills when analysing a mock disaster scene. The data collected assists in identifying and interpreting any nascent or self-developed experiential strategies used by the SOCO's. It is generally hypothesised that the SOCO's would complete the task more efficiently than inexperienced personnel and be able to correctly identify the most evidentially probative items from a particular disaster scene. This hypothesis has been tested using the data created from the Eyelink equipment.

Introduction

SOCO's have many responsibilities they must comply with throughout an investigation, beginning with confirming that a crime has been committed, secondly preserving the scene to the best of their ability. It is essential that SOCO's have the ability to recognise key areas within a scene to recover crucial evidence as well as recognise particular patterns occurring as they are considered to be experts within their field of studies.
A 'disaster' could be best described as a sudden event that disrupts the functioning of a community due to a large scale of damage or loss of lives (International Federation of Red Cross and Red Crescent Societies, 2015). In mass murder the term mass is defined as 'involving or affecting a large number' whilst murder is the killing of a person(s) with intent (Crown Prosecution Service, 1985). Mass murder is therefore summarised as the unlawful killing of several individuals indiscriminately, usually in one location.

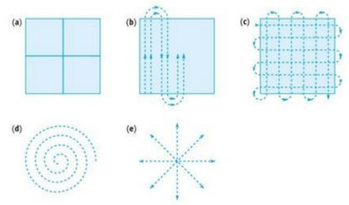

Figure 1: Systematic approaches advised to help thoroughly search crime scenes (Jackson and Jackson, 2011).

(Baber and Butler 2012) believe that experts often take on the modus operandi of the suspect resulting in recovering more evidence; whilst also mentally reconstructing the steps of the suspect. This however is not one of the usual search patterns suggested that are used by our experts such as the spiral, line or grid method (Jackson and Jackson 2010). These search patterns are systematic approaches to a crime scene to ensure the Crime Scene Investigators have thoroughly examined a scene in the most efficient way. Usually senior Scene of Crime Officer (SOCO) attend such scenes to examine and recover evidence as explained by (Gooch and Williams, 2007) and it is in the SOCO's opinion, whether an item is worth recovering due to its evidential value.

"Disasters always present many different and unique challenges which must be addressed right away. The one constant in disasters is change" (Byrd, 2000).

Below is Figure 2 (left hand side) a fixation map of a participants results, the green area indicating which areas were analysed, the red indicating the items of evidence that were focused upon.
Figure 3 (right hand side) is a saccade map which shows the direction of eye travel and the route taken, an apparent systematic approach was carried out.

Method

The participants are asked to sit on a chair in front of a computer screen, with their head and chin resting on the provided rests, this is due to the rest being in calibration with the eyelink camera to track eye movement, therefore obtaining the most accurate results. They are in the room alone however have contact to the control room via cameras and microphones.

Each participant is asked to read through the instructions on the screen ahead, before calibrating their eyes to the device individually. This calibration consisted of the participants staring at a black dot in various areas of the screen, whilst the control room confirmed or rejected the calibrations for each dot.

After calibration the participant was able to proceed with the experiment, which consisted of a series of five images in total, each on screen for 120 seconds per image. The participants did not need to talk through their analysis, they just needed to analyse the scene to their best ability to identify any key items with potentially high evidential value.

Results

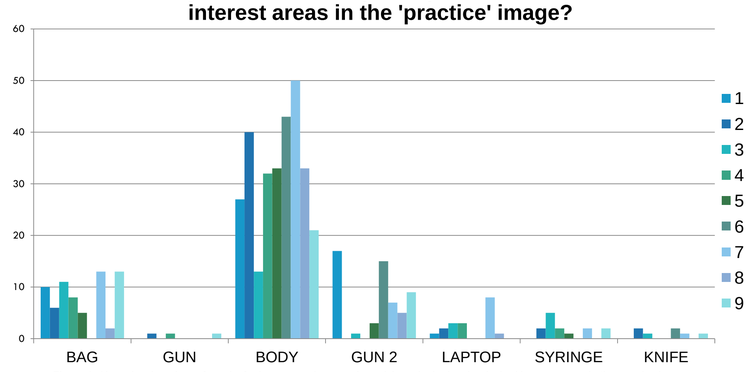

Figure 4: Above is a bar chart of results for how many times each participant looked at the desired interest areas in the practice image.

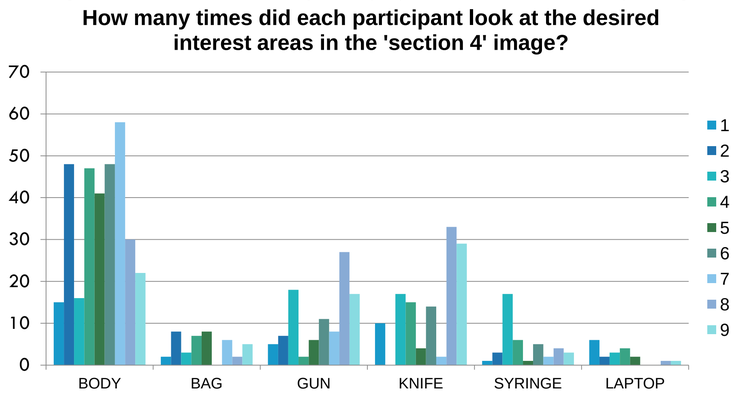

Figure 5: Above is a bar chart of results for how many times each participant looked at the desired interest areas in the section 4 image.

Participants	1	2	3	4	5	6	7	8	9
Dwell Time % for the Body in Practice image	9.24	12.81	3.81	11.92	9.57	11.99	16.13	10.65	6.15
Dwell time % for the Gun in Practice Image	0.00	0.41	0.00	0.27	0.00	0.00	0.00	0.00	0.29
Dwell Time % for the Body in Section 1	11.95	2.75	2.07	6.36	11.83	11.44	12.44	8.67	8.20
Dwell time % for the Laptop in Section 1	8.67	2.13	2.19	3.37	4.31	0.55	1.45	0.43	0.90
Dwell Time % for the Bag Section 2 image	8.85	6.13	7.32	5.67	4.13	3.67	3.54	3.31	1.52
Dwell time % for the Laptop Section 2	0.74	0.77	0.99	0.77	0.13	0.00	0.00	0.26	0.36
Dwell Time % for the Knife Section 3	15.09	8.27	3.51	3.16	3.90	0.97	2.16	18.03	5.98
Dwell Time % for the Body Section 4	4.10	14.35	3.80	12.46	11.53	14.33	16.53	9.37	5.99
Dwell time % for the Laptop Section 4	1.64	0.76	0.55	1.34	0.51	0.00	0.00	0.19	0.33

Table 1: A table from all five images, showing the dwell time percentage (amount of time) spent on particular items within the images.

Discussion

It is apparent that the participants tend to approach the body as their key area of interest on the practice image, potentially due to the body being an easily identifiable object and a slightly larger piece of evidence in comparison to some of the other types present. Referring to figure 4 and table 1, participant 7 looked most frequently at the body as well as for the longest period of time, whilst participant 3 looked the least amount of times for the shortest period of time. Although the amount of fixations will impact the dwell time percentage slightly, participants that have analysed the body less times have focussed upon that item for a longer period than others, i.e. participant 2 fixated on the body 40 times within the two minutes whilst participant 6 fixated on the body 43 times. Participant 2 spent 12.81% of their time fixated on the body whilst participant 6 spent 11.99% for the practice image. The observations of each item tend to have a large variance in numbers of times it has been looked at by different participants. In this image, it appears student participant 8 looked at the gun over 50 times, (54 times) for 19.25% of the allotted time whilst SOCO participant 4 looked at the gun in this image on one occasion for 0.16% of the allotted time. When SOCO participant 5 was present for the practical they stated that once they had noticed an item and taken its potential relevance of the scene into account that then affected the amount of times he further analysed it. This therefore could have an effect on the results found due to each participant's cognitive approach and mentality. In section 3 there was only one interest area highlighted which was the knife which received 182 views in total. Participant 8 looked at the knife a significant amount of times compared to all other participant's, analysing it approximately 3 times more than the average amount calculated by the other 8 participants. The amount of views within this image are varied, many participants over analysed a sandal in the top left corner of the image, mistaking it for a possible gun due to the positioning, as found with post narrative feedback. Although, this item was not an interest area and therefore it cannot be calculated how many views it received alone, it does appear that the sandal was present in the most viewed grid of the image. Despite the desired approach of searching outlined by (Jackson and Jackson, 2011) it is apparent that when analysing a scene, participants do not 'naturally' use this strategic method of analysis. This research project confirms that the statement is true to a degree, as participant 5's saccade image found in figure 3 shows a slight strategic approach carried out however this was resulted as abnormal searching as other results from participant 5, showed 'natural' eye scattering searching.

Conclusions

This is the first report to show that when using visual search strategies monitored by eye tracking equipment: there is no significant difference between the SOCO's fixation counts and dwell times as opposed to the students, as there was no time where the SOCO's noticeably fixated on an area or object more than the students. There was a great variety within the results to conclude that there is no significant difference between the two groups of participants, however between the nine participants as a whole it appears that participant 8 (student) and Participant 7 (SOCO) both analysed the desired interest areas on more occasions than other participants, whilst also then averaging out within other interest areas. The data suggests at this time the technique carried out was not valuable enough to use on behalf of competency testing or police training purposes due to no repeat experiments carried out for the practical, as the nature of the project was to test the participants without preconceived opinions.

Acknowledgements

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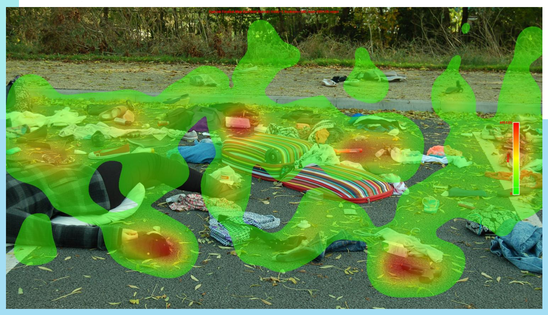

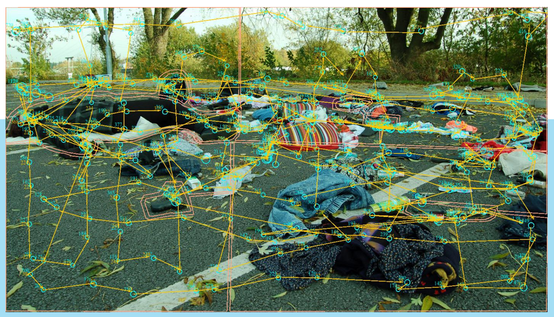

References

Baber, C. & Butler, M. (2012) "Expertise in Crime Scene Examination: Comparing Search Strategies of Expert and Novice Crime Scene Examiners in Simulated Crime Scenes", *Human Factors: The Journal of Human Factors and Ergonomics Society* 54, 3, 413-424.
Byrd, M. (2000) *Disaster Management Lost innocents.* [Online] Available from: http://www.crime-scene-investigator.net/disaster.html [Accessed: 24/11/15].
Crown Prosecution Service (1985) Homocide: murder and manslaughter. [Online] Available from: http://www.cps.gov.uk/legal/h_to_k/homicide_murder_and_manslaughter/ [Accessed: 24/11/2015].
International Federation of Red Cross and Red Crescent Societies. (1863) *What is a Disaster?* [Online] Available from: http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/what-is-a-disaster/ [Accessed: 20/01/2016].
Jackson, A.R.W. & Jackson, J.M. (2011) *Forensic science*, 3, 41, Prentice Hall, Harlow.
Support Research. (2014*) Eyelink 1000 desktop mount.* [Online] Available from: http://www.sr-research.com/mount_desktop.html [Accessed 13/11/2015].