A team leader's gaze before and after making requests in emergency care simulation: a case study with eye-tracking glasses

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INTRODUCTION

The advanced technology of eye-tracking enables us to analyse healthcare professionals' (HCPs) gaze behaviours. Gaze analysis has great potential to capture HCPs' non-technical skills, especially *situational awareness* (SA).[1] The SA framework has three levels. Level 1 involves perceiving an event, level 2 understanding what is being perceived importantly and level 3 being able to make predictions. How to analyse HCPs' utterances and gaze in an integrative manner may provide insights into higher-order cognitive skills such as level 3 SA. This study aims to establish a method to describe HCPs' gaze and utterances in emergency care interactions, focusing on a leader's gaze at team members' faces and bodies when making requests.

METHODS

One simulated training session (about 16 min) was analysed, applying a multimodal corpus approach. The recording took place in the resuscitation area at Yokohama City University Medical Center. The team comprised a senior consultant as a team leader (Leader) with an eye-tracker, Tobii Pro Glasses 2, another two doctors (a senior doctor (SD) and a junior doctor (JD)), a foundation doctor and two nurses, and a simulated patient (male, 60 years old, not a real patient) took part in a scenario of brain haemorrhage. The patient was unconscious on arrival, and the team inserted an intravenous line, intubated the patient, and did CT scans and X-rays before leaving for the intensive care unit. Before arrival, the Leader asked the SD to intubate and the JD to insert an intravenous line.

The gaze data were stored in an application, iMotions,[2] and transferred to an annotation tool, ELAN.[3] iMotions automatically annotates gaze fixations more than 100 ms, but to capture shorter fixations, his gaze visualised on the viewer of ELAN (more than 0.001 s) was manually annotated first by research assistants and then checked/revised by one of the authors (KT). The Leader's utterances were also transcribed with annotation conventions; that is, <...> indicates extra linguistic information, and the lengths of gaze fixations in seconds are provided in brackets.

RESULTS

Table 1 shows the total number and dwell time of the Leader's fixation on team members' faces and bodies, with the percentages and the average fixation lengths. The total number and time length of his fixations on each member are shown on the left.

The Leader looked at the patient most (499 times and about 3 min). His total fixation time at the SD and the JD were about 1 min each, and on the other HCPs around 35 s or less. The Leader gazed at his team members' bodies more than their faces. This behaviour was more frequent towards the JD. Therefore, we concentrated on the Leader's gaze at the JD to establish a method to describe the interactions.

There were six occurrences of the Leader making requests to the JD, which were assigned to three categories: (1) asking for immediate actions (three instances), (2) asking for information (two) and (3) sharing a future plan (one). We focused on only the first here.

The Leader's gaze behaviours within 2 s before/after his request utterances are described in the tables. The leadtime, which is the length of time between the timing of his gaze and that of his utterance, is also added to the transcript. In table 2, the Leader gazed at the JD's body four times before making a request. After he asked the JD to insert an intravenous line, he gazed at him from the back, walking towards the other side of the room.

In the other two instances of his immediate requests, the Leader gazed at the JD just before making his requests, and the leadtime (−0.6 and −0.39, respectively) is shorter than the first case above (−1.60). In the two cases, the Leader's gaze was prompted by team members. In table 3, after the JD's insertion of intravenous line, the SD asked whether the JD had filled the blood tubes, to which the JD responded "yes". The Leader then saw the JD and asked him to pass the blood tubes to a nurse.

DISCUSSION

Exploratory analyses found that the Leader gazed at the JD's body repetitively before requests, observing the JD's actions. The leadtime between his gaze and request is shorter when he was prompted by the members' utterances. Although there are other methods to track eye gaze, for example, heatmaps[4] and conversation analytic

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Table 1 Number and time of Leader's fixations on the member's face and body

	Face					Body					Total			
	n	%	Time (SS.0)	%	Average (time/no)	n	%	Time (SS.0)	%	Average (time/no)	n	%	Time (SS.0)	%
Patient	105	21.04	26.38	15.03	0.25	394	78.96	149.15	84.97	0.38	499	15.25	175.52	14.60
Senior doctor	50	20.75	16.44	26.37	0.33	191	79.25	45.89	73.63	0.24	241	7.37	62.33	5.18
Junior doctor	17	9.24	5.72	9.65	0.34	167	90.76	53.57	90.35	0.32	184	5.62	59.29	4.93
Foundation doctor	28	18.42	8.97	27.06	0.32	124	81.58	24.19	72.94	0.20	152	4.65	33.16	2.76
Nurse A	37	24.50	6.64	18.64	0.18	114	75.50	28.97	81.36	0.25	151	4.61	35.61	2.96
Nurse B	18	20.00	4.64	24.40	0.26	72	80.00	14.38	75.60	0.20	90	2.75	19.02	1.58
Others											1955	59.75	817.49	67.99
Total											3272		1202.43	

Table 2 Request to JD_1 (intravenous line)

Time	Leadtime	Speaker	Transcription
04:29.9	−1.60		\<L gazes at JD_body (0.046)\>
04:30.6	−0.92		\<L gazes at JD_body (0.486)\>
04:31.1	−0.44		\<L gazes at JD_body (0.343)\>
04:31.5	−0.01		\<L gazes at JD_body (0.189)\>
04:31.5	0.00	→Leader	じゃあ\<JD's name\> ルート取って. *Now \<JD's name\> insert an IV line.*
04:31.9	0.43		\<L gazes at JD_body (0.234)\>

JD, junior doctor.

Table 3 Request to JD_2 (blood taken)

Time	Leadtime	Speaker	Transcription
05:32.2	−10.61	JD	ルート右前腕 20ゲージ 採血しました. *I've placed a 20 gage IV line on his right forearm and taken blood.*
05:39.9	−2.90	SD	採血した これ？ *Have you taken blood? This one?*
05:42.1	−0.71	JD	はい. *Yes.*
05:42.2	−0.60		\<L gazes at JD_body (0.369)\>
05:42.5	−0.23		\<L gazes at JD_body (0.366)\>
05:42.8	0.00	→Leader	採血じゃあ出して. *Then give the blood [to a nurse].*
05:42.9	0.14		\<L gazes at JD_body (0.145)\>
05:43.3	0.50		\<L gazes at JD_body (0.029)\>
05:43.7	0.91		\<L gazes at JD_body (0.243)\>
05:47.4	4.57	Nurse A	採血もらいます. *I will take the blood.*

JD, junior doctor; SD, senior doctor.

approaches,[5] through this multimodal corpus analysis with gaze and utterances, the Leader's attention becomes observable on timeline, which can further elucidate the process of making predictions.

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