

Fog of Triage: Usage of the Fog of War concept for the Triage in a Mass Casualty Incident (MCI)

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Abstract: This paper describes the adaption of the Fog of War concept, known from real-time strategy games, to the triage in a mass casualty incident (MCI). During the triage the patients are categorized according to the severity of their injuries. The main goal of this study is to investigate if the Fog of War concept improves the performance of the triage process. The Fog of Triage (FoT) concept has been implemented and evaluated in an user-centered-study with the Arbeiter-Samariter-Bund (ASB) München¹. Two applications have been implemented: Digital Triage application and Fog of Triage application. The Fog of Triage applications extend the Digital Triage application using the Fog of War concept. In an evaluation with six subjects the Digital Triage application was compared to the Fog of Triage application. The measured parameters were: time per patient, System Usability Scale (SUS) and NASA Task-Load-Index (NASA-TLX). In addition a qualitative feedback was gathered through interviews. There were no statistically significant differences between these two applications considering the measured parameters. In the interviews the majority of the subjects rated the Fog of Triage concept as useful. Therefore, the FoT provides an additional benefit without reducing the performance of the digital triage. This research is part of the SpeedUp project².

1 Motivation

The main goal of the SpeedUp project is to speed up the triage in a mass casualty incident (MCI). In an MCI not all injured can be treated immediately. The patients are categorized according to the severity of their injuries to maximize the chance of survival. This categorization is called triage. Seriously injured patients are treated immediately, whereas

¹The Worker's Samaritan Federation (Arbeiter-Samariter-Bund Deutschland, ASB) is an aid and welfare organization devoted to rescue services.

²The project SpeedUp is funded by the German Federal Ministry of Education and Research (BMBF) within the program „Research for Civil Security“ (May 1st, 2009 - April 30th, 2012, FKZ: 13N10175). Website: <http://www.speedup-projekt.de>

the treatment of slightly injured patients is delayed. The probability of mistakes and inaccuracies increases because of the stressful and chaotic situation during the triage process. For instance, it can happen that a paramedic has to search for an injured person before first aid care can be provided and transport to hospital can be arranged. This additional effort requires a lot of time and reduces the chance of survival of all injured, not only of one individual. With a digital triage system inaccuracies could be avoided. In addition, it is helpful to know in which sections the triage has been completed to avoid unneeded screenings. The Fog of War concept from real-time strategy games is a possibility to keep track of screened areas.

2 Related Work

Other projects in the context of digital aid for triage in an MCI are, for example, e-Triage and WIISARD: The e-Triage project is a digital triage system using tablet PCs for data entry and distributed databases for data synchronization between paramedics and emergency service operation controls [DEA⁺11]. The digital triage system developed in the WIISARD-project uses mobile WiFi hotspots with GPS, which are deployed to build up an independent communication infrastructure. Patients that have been screened during the triage are labeled with intelligent patient tags. These tags provide patient location and identification. They store local triage data and send them to the operation controls [KCB⁺06][LPCR05].

The Fog of War concept, appearing first in the real-time strategy game Warcraft II³, hides areas that are not observed by the player. This means that enemy units are hidden from the player, while the terrain is still visible beneath a fog. The player not only has to explore the map once, but also has to observe the map continuously with his units.

To the best of our knowledge no project has yet investigated the usage of the Fog of War concept for the triage of an MCI. In our study we present the first approach to apply Fog of War to the triage process.

3 Method

In a user-centered development four Android applications were developed: Fog of Triage (FoT) application, used by the paramedics for the triage of the patients, FoT overview application, used by the ambulance incident commander (AIC) to get an overview of the position of the patients, Digital Triage application, used by the paramedics and Digital Triage overview application, used by the AIC. Our approach in the evaluation was to conduct a comparison between the digital applications and the FoT applications. The applications were developed with Android 4.0.3 using the Google Maps API.

³See: <http://arstechnica.com/old/content/2005/10/gamingevolution.ars/12> (visited 2012-12-04)

3.1 Apparatus

The FoT application and the Digital Triage application were installed on an ASUS EeePad Transformer TF101, equipped with an anti-reflection display foil from Diphos. The two overview applications were installed on an ASUS EeePad Transformer Prime TF201. The LG Smartphone P920 Optimus 3D was used as an access point for mobile internet.

3.2 Evaluation

During the evaluation the Digital Triage application was compared to the FoT application. Six participants from the ASB took part. The participants were between 25 and 59 years old, therefore the average age was 41.5 years. The hypothesis of the evaluation was that the FoT concept improves the speed of the triage without increasing the stress for the paramedics.

4 Results

The following sections present the most important qualitative and quantitative results of the evaluation.

4.1 Quantitative Results

To test the hypothesis of the evaluation Time per patient, System Usability Scale (SUS) value and NASA Task Load Index (NASA-TLX) value were measured. The SUS indicates how usable an application seems to be [Bro96], whereas the NASA-TLX measures how demanding a task appears to be for the user [HS88].

Application	Time per patient	SUS	NASA-TLX
Digital Triage	29.67s (6.38s)	76.25 (13.94)	7.08 (1.51)
Fog of Triage	29.83s (18.12s)	77.92 (13.39)	7.64 (1.02)

Table 1: Results of time per patient, SUS and NASA-TLX and their standard deviation in brackets

Paired t-tests failed to prove that these differences are statistically significant.

4.2 Qualitative Results

Qualitative feedback was gathered in interviews. The most important results were: Transmitting the triage data directly to the AIC was considered to be useful; all applications were easy to use; the Fog of Triage concept was reasonable; a scale could be useful to get an estimation of the revealed area.

5 Discussion and Future Work

The quantitative results are not statistically significant, but the qualitative results are promising. It can be concluded that the Fog of Triage concept yields a benefit for the triage and does not have a negative influence on the usability. The significance could be revisited in another evaluation with more subjects. We recommend to implement these features in the next prototype:

Define the section on the map; move and remove the patient markers (i.e. when a patient is transported to the hospital); save the intermediate steps for each patient in the triage algorithm in order to obtain a more accurate first diagnosis; manually specify the size of the revealed area; place comment markers on the map.

The following features were required by the participants in the interviews:

Manually specify the size of the revealed area; the use of a bigger font; adapt the buttons for bigger hands; the AIC should have a scenery overview and the total number of patients in the area; display a scale to estimate the dimension of the revealed area; add additional information to the patients (i.e. patient has a craniocerebral injury). These features should be implemented in the next iteration of the prototype.

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