Discovering the terrorist

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ABSTRACT

The adoption of Visual Analytics methodologies in security applications is an approach that could lead to interesting results. Usually, the data that has to be analyzed finds in a graphical representation its preferred nature, such as spatial or temporal relationships. Due to the nature of these applications, it is very important that key-details are made easy to identify. In the context of the VAST 2008 Challenge, we developed a visualization tool that graphically displays the movement of 82 employees of the Miami Department of Health (USA). We also asked 13 users to identify potential suspects and observe what happened during an evacuation of the building caused by an explosion. In this paper we explain the results of the user testing we conducted and how the users interpreted the event taken into account.

KEYWORDS: user testing, evacuation, visual analytics, casualties detection.

1 INTRODUCTION

The VAST2008 Challenge consisted of four mini-challenges. Teams could either choose to participate in all of them, or in a single one (a detailed description is available at [1]). All challenges were related to the fictional religious movement called "Paraiso". We focused only in one challenge, the one set in the Department of Health (DoH) building in Miami, where a small device was set off causing some damage and casualties. In order to participate to this challenge the team was asked to identify potential suspects, witnesses, casualties and the estimated location of where the device was set off.

2 DATA

The DoH building was the site of an experiment where each employee wore a badge equipped with an RFID that enabled the tracking of his/her movements. Data about the employees movements during the time of the incident was available in a text file that, for each "tick" (time instant) linked the RFID tag to their actual X and Y coordinate on the map. The actual map was provided with another text file and another file linked each RFID tag number to their "real" name.
The leading idea for our experiment was that by observing the movements of the employees , the observer could have some insights on whether or not they would be implied in the bombing.

3 RELATED WORK

The simulation of natural or human-made disaster is a topic that has gained attention, especially after the 9/11 events. Johnson argues that the CHI communities should try to gain valuable insights from those events and try to address the unexpected challenges in hope of improving the effectiveness of emergency personnel and escape plans [2]. The study of escape plans is also an interesting direction for research: Andrienko et al [3] describes an automatic scheduling algorithm generator able to generate evacuation plans, subsequently analyzed by human operator in order to judge their feasibility. Kim et al [4], developed a tool dedicated to first responders, for the analysis and representation of sensor network data. Their system displays on a mobile device, both in 2D and in 3D, a graphical representation of the situation of people in a building, complete with their supposed health level.

4 USER TESTING

We let a group of 13 users of Computer Science background, test our system by experimenting with the interface. Each users was briefly instructed on how to work with the two visualization modes we provided with the tool and what the purpose of the experiment was. In the first mode, an animation of each person's movement during the time recorded is displayed. Each person is represented as a green dot that moves across the map. Users can interact with the animation by pausing and resuming it, advancing or rewind it frame by frame. In the second visualization method, instead of showing the actual animation, we use the movement data to trace a line that represents their path during the course of the animation. Users can customize this visualization by choosing the starting and ending point (in terms of keyframes) of their path. In this way users can, for example, show which persons moved prior to the detonation of the bomb, or which person actually passes through the area of the explosion. We then left each user alone and free to interact with the interface. From our observations, the majority of users relied on the visualization mode that lets them see the animation of the movement of the employees. From our observations, only 2 of 13 used the "tracking" visualization mode allowed by the application while the others simply relied on the animation mode. All of the users repeatedly watched the animation and quickly concluded that the place of the detonation probably occurred in the northeastern quadrant (except one), due to the fact that most of the employees that were present in that area, after the supposed explosion of the bomb, "stopped moving" (as most of the interviewed said). This observation made them more interested in the events that occurred in the area marked in Figure 1. By looking more closely at that part of the animation they were able to identify a number of potential suspects and witnesses to the detonation. A feature that was used often was the ability to "highlight" a person and follow his/her movement through the animation (since each person is rendered as a green dot, it would have been easy to lose sight of them otherwise). Each test usually lasted between 10 and 15 minutes. After this time span (which was not enforced), the users usually reported to us that they had "concluded their observations", so that we could begin the interview. Every one of them, (except one) agreed that the explosion must have occurred after frame 370, which probably marks the time of detonation or the time when the alarm is activated. In fact soon after that frame, everyone starts fleeing towards their nearest exit, leaving some of the employees of the northeastern quadrant fixed on the spot (identified as probable casualties by the interviewees).

Street Address and Electronic Mail Address

We then proceeded to ask them the same questions that are reported on the answer form. The results of this testing shows that 76,92% of the interviewed agree that Number 21, Mr. Ramon Katalanow is the most probable suspect of having detonated the bomb. The fact that so high a percentage of the interviewed agrees on his guiltiness is an interesting fact. As a side note, it also has to be observed that his last name is dangerously similar to that of the Catalano family, the clan whose leader, Fernando, is "responsible" of the Paraiso Manifesto. All the interviewed users agree that his behavior is certainly suspect and it can be described in the following way: "he moves from his room to a room with two occupants where he either throws the device inside the room or activates it before exiting his room; subsequently, he flees and hides on a corner wall before escaping the facility". Some of the other users expressed their concern towards the behavior of Number 13 and 59. In fact, they suspected that number 59 tries to escape the building, then changes direction and returns inside towards another exit (perhaps?). Number 13 follows 59 and at some point 59 "stops moving". Those users that noticed this suspicious behavior thought that 59 must have been a witness to the event and that she was killed by 13. They were not able to explain why because 59 does not seem to be very close to the zone of detonation, but since more than one person noticed it, it could become relevant. Detailed results are shown in Table 1.

Category	RFID Nr.	Value
Suspect Terrorist	**21**	**76,92%**
Other suspects	**28**	**30,77%**
	29	**30,77%**
Witnesses	**1**	**60,00%**
	18	**50,00%**
Escapees	All interviewees correctly concluded whether his/her suspect or witnesses escaped	
Casualties	**18, 19, 36, 39, 47, 50, 56, 60, 65, 69, 76, 78** identified by **53,84%**	

Table 1. Main results

When asked to determine which ones amongst the employees could be witnesses to the event, the interviewed assumed that those who could be connected by an uninterrupted straight line to the suspect could have seen something. In fact data about each person's orientation was not available. Therefore, by assuming that Nr. 21 is the most probable suspect, then a witnesses is everyone that has him in his/her "line of sight", at some point during the animation. We observed, though, that the persons that we interviewed did not manage to identify all the potential witnesses (all those that "see" Nr. 21). We think that this is probably due to the fact that they spent more time on finding persons with a suspect behavior, rather than checking which of the other persons could have seen him. As a future improvement, this process of finding all persons that have a designated one in their line of sight at a certain moment could be automated, therefore easing the burden for the interviewees.

Finally we asked where, according to their findings so far, the bomb had detonated. We used the feature that allows the user to place a red transparent circle to mark the location of the bomb. After each user was satisfied with the location and radius of their "bomb" we annotated the coordinates down. The final location that we reported on the answer form was the room chosen by the majority of the interviewees.

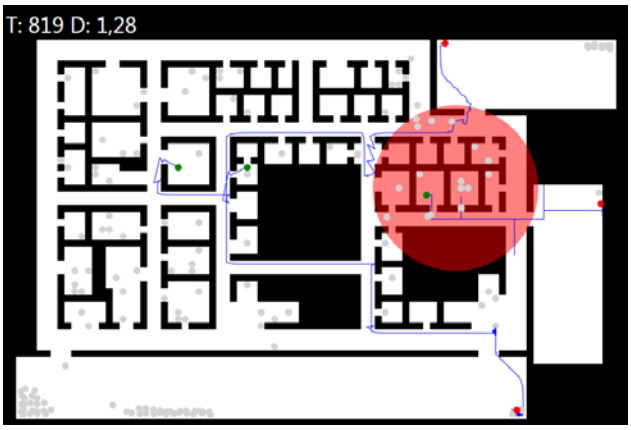

Figure 1. The second visualization modes, showing the tracked path of three suspect and a possible bomb placement

5 Conclusion

The user testing conducted in our experiment shows there is a very strong suspicion about Nr. 21's implication in the bombing. The fact that most users agreed on this, cannot certainly be dismissed as a random occurrence.

References

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