

How to support situation awareness in operational crisis Management: Case studies

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ABSTRACT

Situation awareness is created through the dynamic process of perception and action and serves as a foundation of overall performance throughout many different domains, such as education, military operations, air traffic control, driving, search and rescue, and crisis management [Endsley, 2006]. Information sharing is an important factor to be consider in situation awareness. In this paper, we present how tools can support information sharing in crisis management. So, we study how crisis management team dealt with two exercices using firstly whiteboards and secondly, CRIMSON a digital decision support tool.

Keywords

Situation awareness, Information sharing, crisis management decision making

INTRODUCTION

It is becoming increasingly evident that awareness is critical to successful collaboration and provides a context for individual activities that facilitate group. Awareness was described as perceiving the practices of others, which gives a setting for your own practices [Dourish & Bellotti, 1992]. This context is used to guarantee that singular activities and participation are essential to the group's activity in general and to assess individual actions with respect to group missions and advancement. Moreover, this information enables groups to conduct and maintain collaborative activities [Belkadi et al., 2013]. Different types of awareness have been identified especially in CSCW studies [Stanton et al., 2017]. For instance, we can note, activity awareness that is described as perceiving what is going on around you and involves being aware of the objectives and plans of collaborators [Carroll et al., 2006] and Situation awareness that is created through the dynamic process of perception and action and serves as a foundation of overall performance throughout many different domains, such as education, military operations, air traffic control, driving, search and rescue, and crisis management [Endsley, 2006]. More succinctly, it has been recognized as an essential element in decision-making in dynamic and complex situations [Endsley, 1995]. In this paper, we study how shared information support tools can help in crisis situation awareness. Our main research question is: how digital and non-digital tools can help to obtain common perception of the crisis situations at different times. We analyze two exercices of crisis situations using the PRESAGES Crisis management exercices

Platform¹. The first one is without any digital tools and the second one with digital information sharing support tools. We present in the following the results of this analysis.

ORGANIZATION OF CRISIS MANAGEMENT IN FRANCE

Several actors are involved in crisis management from national to city levels (Figure 1). In fact, dependent of the gravity and the spread of the situation, the mayor of the city is firstly the responsible of the population safety, the city government delegate and the department president can then be concerned by the crisis management. If needed, national organizations and ministers will be involved and take the lead in the strategic level. At operational one, different actors contribute to face problems. We can note especially emergency and medical actors (hospitals, ambulances, emergency departments, Health organizations), firefighters’ organizations (national and local ones), police organizations, social and civil safety associations (Red Cross, Civil protection, White cross, social Media analysts, ...) and public communications societies (TVs and journals).

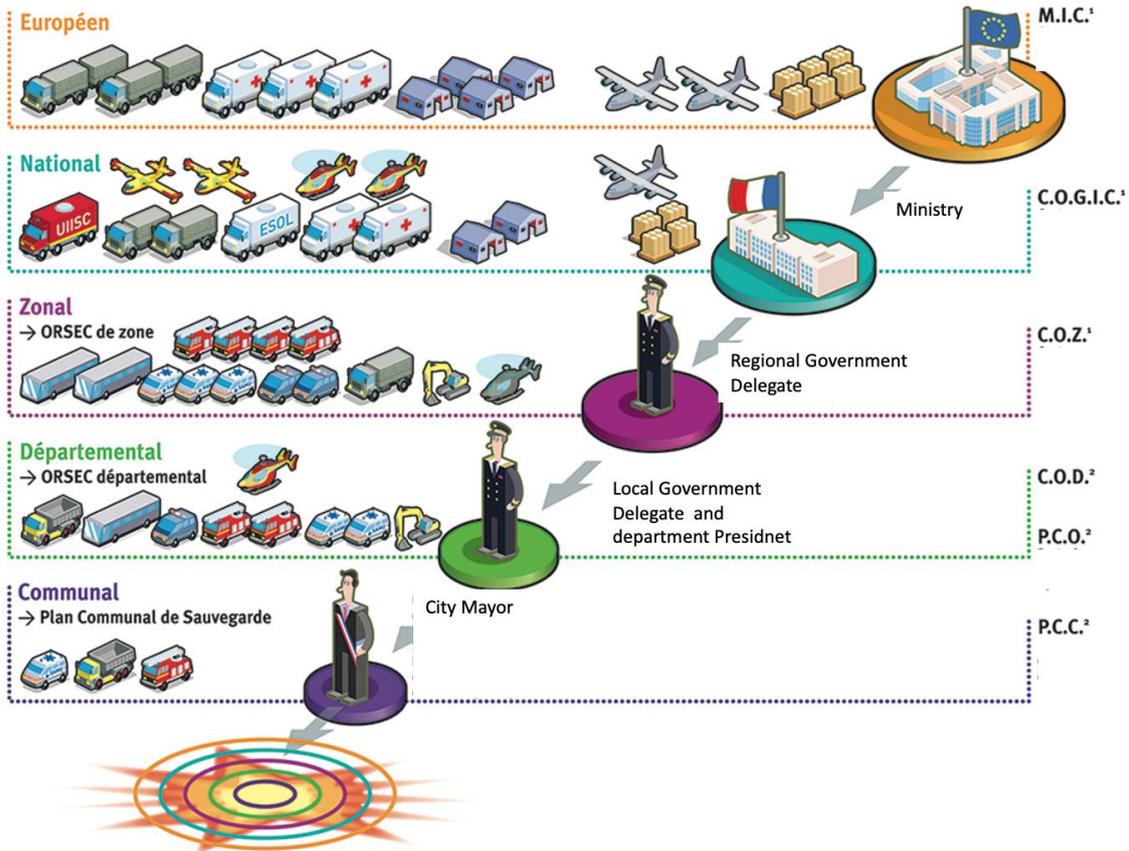


Figure 1. Organization of crisis Management in France ²

SITUATION AWARENESS IN CRISIS MANAGEMENT

The human factors community has generally discussed the concept of situation awareness. Situation awareness refers to the instant state of knowledge in the world that an individual requires to maintain a complex system or activity. Endsley defined it as “the perception of elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future” [Endsley, 1995]. Researchers in different areas have determined that expert decision-makers start with classifying and understanding a situation, and proceed then to decision making [Endsley, 1995; Kulyk et al., 2008]. However, regardless of the adopted definition, the ability to acquire situation awareness as well as the ability of understanding and projection is not necessarily identical for different people who have perceived the same information. This ability depends on the individual information processing mechanism which is related to the personal capacity, experiences, and training.

Situation awareness has vital importance in collaborative environments since it can improve team performance by improving the quality of made decisions [Endsley, 1995]. In crisis management, establishing a high level of

¹ <https://isga.utt.fr/plateforme-presages-1>

² <https://www.gouvernement.fr/risques/dispositif-orsec>.

situation awareness is fundamental to lessen undesirable consequences. This awareness may help to anticipate unexpected scenarios and prepare adequate plans. In numerous rescue operations and emergency response training programs, students are shown the benefits of visualizing the situation before arriving at the intervention site. This visualization helps to perform primary analysis of the situation and to decrease the response time. Intervention team members usually have a certain period while heading toward the intervention site. During this time, it is very interesting to analyze and examine the available information such as the description of the accident and to predict what kind of difficulties can be encountered by the intervention team in the near future [Shimanski, 2008]. So, It will be interesting to analyze how information sharing support can help in situation awareness especially when actors are in stressed situations. We discuss in the following this type of contributions through the observation of crisis management exercises.

CRISIS MANAGEMENT EXERCISES

In order to analyze the contribution of information sharing tools in situation awareness, we observe the crisis management strategic decision committee of two exercises. These exercises have been done in the PRESAGES' crisis Management Training platform³. PRESAGES is a platform that physically reproduces a crisis cell and is equipped with fixed and mobile cameras to capture general views and zoom in on situations of interest, collective microphones to capture the ambient sound content, and individual lapel microphones to collect interpersonal discussions. The platform also makes it possible to recover the interaction media that is exchanged during each simulation (e-mails, tweets) (Figure 2).

In these two exercises, we simulate municipal crisis room. Several whiteboards and TV are installed in order to follow medias situations, as same as, phones that can be dedicated to each crisis actors responsible (firefighters, Emergency, rescuers, policeman, government, communications, etc.).

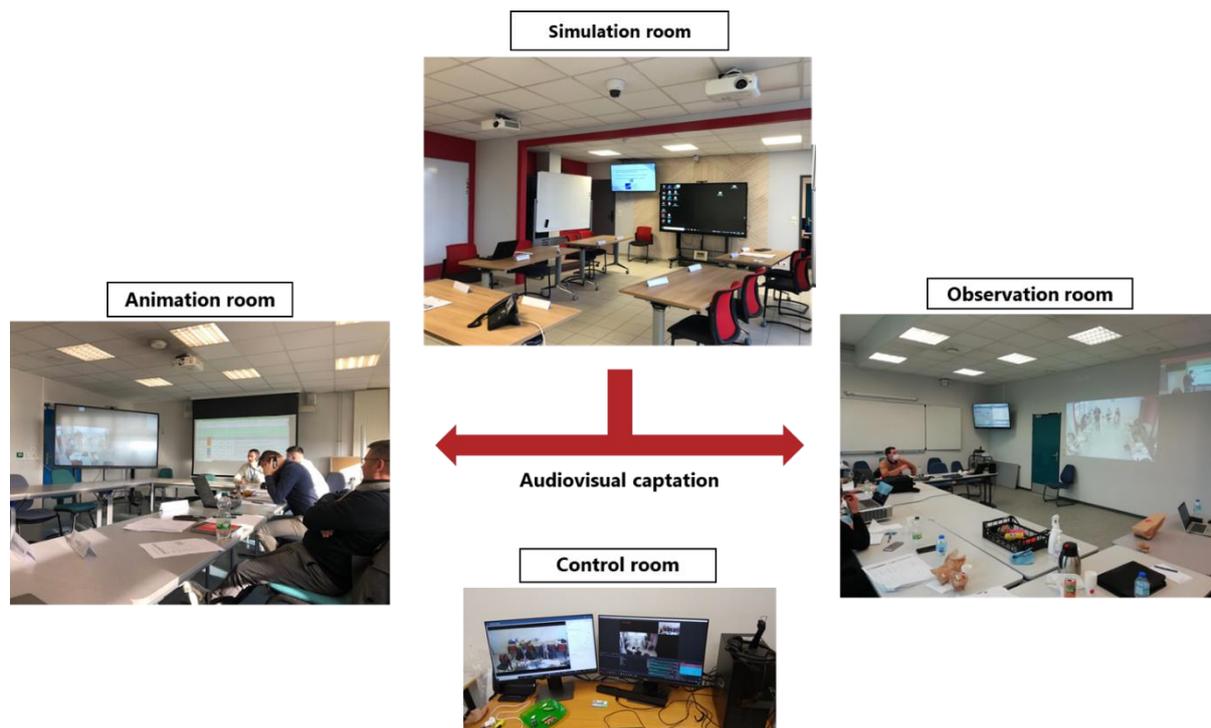


Figure 2. PRESAGES simulation platform.

Audiovisual data is collected from the simulation room, and managed in a control room. An animation room is dedicated to trainers, that can interact with strategic actors using phones and other communication applications: e-mails, discussions forums, etc. A real time analysis takes place in the observation room.

Before each exercise, a scenario is established and communicated to Trainers in order to interact with strategic committee actors. We analyze two exercises based on real crisis situations, the first one concerning a flood on Narbonne city and the second one is about the Yellow Vests troubles at Troyes city.

^{3 3} <https://isga.utt.fr/plateforme-presages-1>

Narbonne City Flood exercise

Narbonne is a big city in the south-Ouest of France (Figure 3). It is along the Mediterranean Sea. Several natural sites are around the city. The highest point of the city is on around 287m of Altitude. Several small villages are around the city. These villages are connected to Narbonne through small roads. There is also a high way beside the city that joins Paris to Toulouse. The Aude River traffic allows to cross the city via the “Robine” river canal.



Figure 3. Narbonne city

The night of 12 November, a big storm cross the city. As consequence, roads around “Robine” river canal and the beach are flooded. Garages on houses are plenty of water. A camping area, near the beach was inundated. A crisis Management team is organized quickly in order to manage and answer several events due to that flood:

- Road accidents inside inundations
- Population transfer from Camping area
- Aid to citizen in flooded houses
- ...

The crisis management team is composed by (Figure 4):

- Director of Operations; a government delegate
- Coordination agent; identified by the team members themselves
- Investigation and Operations interface sub-teams; composed by policeman and rescue’ actors delegates
- Means sub-team composed by department and city delegates
- Communication agent
- Population supports sub-team composed by rescue volunteers’ organizations delegates

This crisis management team have only phones to receive information and communicate with animation’ team. They have also laptops to explore the map of the city and to receive the simulation of social networks interactions.

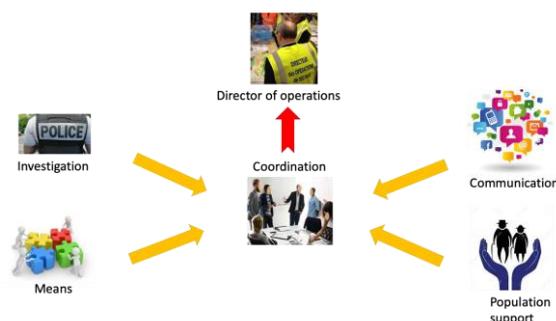


Figure 4. Crisis Management team

The duration of the exercise was 6 hours. The trainers cell composed from several actors, playing the role of population, reporters, rescue, city and government delegates. They have phones allowing them from one side, to communicate new events and from another side, to answer crisis management team’s requirements.

Exercise Analysis

The aim of this analysis is to identify how crisis management team actors used Information and communication support. Each actor organizes his notes differently (Figure 5):

- Listing of means and their capacities
- Actions done and to do as a table
- Summaries of the situations as tables: Victims number, Means deployed, actions done, ...

Adding of that, the communication actor wrote on a white board an update of the situation summarizing (Figure 6) : events, actions, victims and decisions. As same as, a list of actions has been shared on a screen.

On the debriefing at the end of the exercise, actors said that the use of different support was correct. They ask to have more interactive screen specially to interact with the map. The communication’s actor told us that she had some difficulties to obtain information from different actors. The coordination’s actor was comfortable with the white board, he used it to share situations summaries at different times to the director of operations and the mayor.

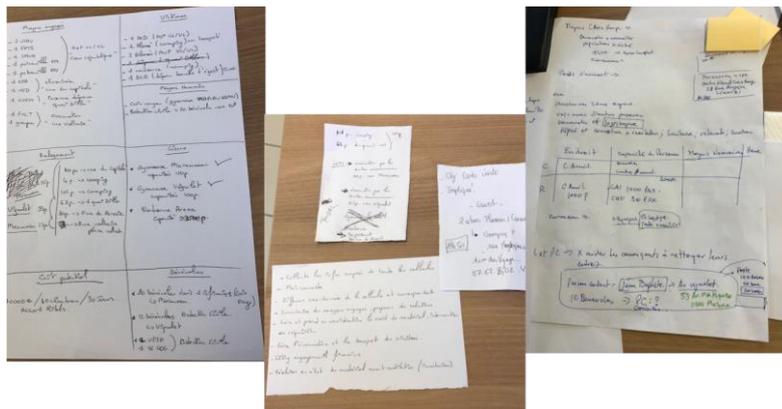


Figure 5. Example of actors’ notes

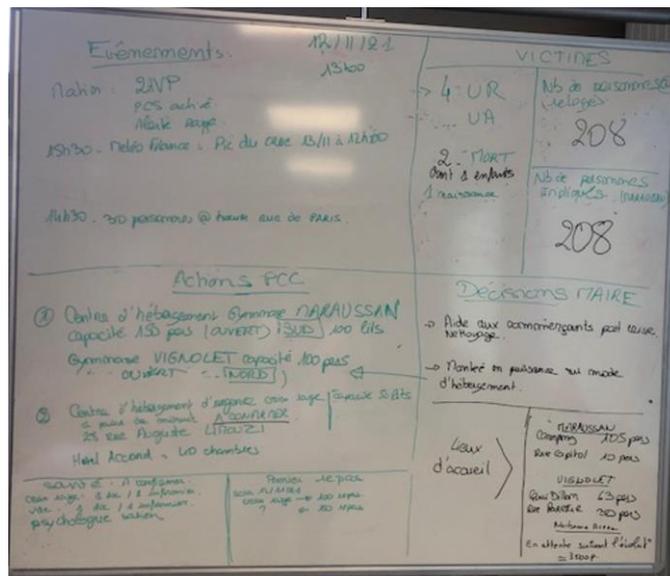


Figure 6. Example of the white shared board

Troyes City Yellow Vests troubles exercise

Troyes is a small city on the North-East of France. It is known by his historical center not far away from the Mayor's and the Department houses. During 2018, Yellow Vests manifestations has been organized every Saturday in each city in France. Some of these manifestations generated troubles in these cities. At 13th December, 2021 10h30 o'clock, an alert about Yellow Vests in front of the Government house led to organize a crisis management team (Figure 7). Several troubles are then signaled like, block out of a school, Government 'house and Mayor house doors break, Fire in a hall in the downtown and road accident near the government' house.

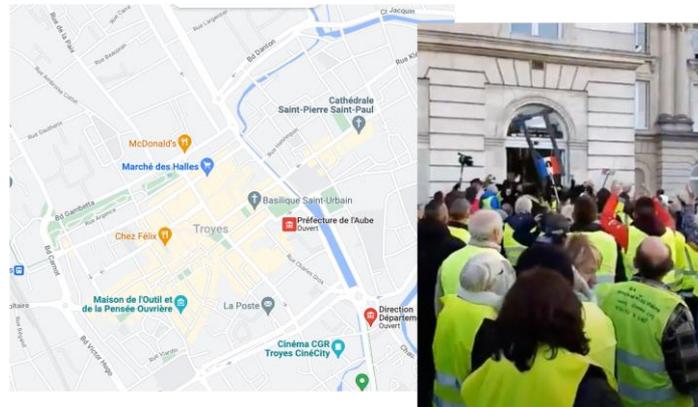


Figure 7. Yellow Vests in front of Government 'house of Troyes city.

The organization of the crisis management team was the same as the one of Flood exercise, but actors change their roles across different service. They had adding to white boards, screens and laptops, interactive screen in which CRIMSON⁴ tools (Figure 8) is manipulated. These tools, developed by CS GROUP⁵ company, offer several services as:

- 2D/3D shared Common Operational Picture display on workstations and mobiles terminals.
- Data sharing considering actors needs to ensure to each command level the optimum information granularity.
- Crisis Management guides and decision support tool.
- Trainers support guides and toolboxes.
- Augmented reality devices to provide situations close to real ones.



Figure 8. CRIMSON tools

Exercise Analysis

Having the same aim as the first exercise, we observe mainly how actors used tools in their management of this crisis. In fact, they didn't use any whiteboard. They interact a lot with the map screen by pointing in it different sites and roads (Figure 9). The director of operations had some problems to obtain summaries. When debriefing, they told us that they need more interactive screens in order to show the summary of the situations at each moment

⁴ <https://crimson.diginext.fr/fr/presentation.html>

⁵ <https://ww.fr/fr/>

as same as other visualization provided by CRIMSON. Adding of that, the summary tool in CRIMSON is very general and adequate to generate reports and feedbacks. But they need to point specific and different types of summaries for instance, victims, means, etc. They didn't use whiteboards for that, they expect Digital tools like CRIMSON will support all aspects of crisis management information sharing needs.



Figure 9. Interaction with Map screen during the crisis Management

CONCLUSION

Situation awareness still a big problem to deal in crisis management. Actors in different sites need to obtain a shared situation information in order to adapt their actions and decisions and especially understand the progress of the situations. Several decision support tools have been defined in order to push towards a common situation information. But these tools are still not accepted by different actors of crisis management belonging to different organizations (health, government, population security, ...) and having different functions. We studied in this paper the use of an example of this digital tool (CRIMSON). The aim of our work is to study how tools (digital or not) can be helpful to crisis management team to obtain a common perception of crisis situation at different times. As summary of this analysis, we can mention digital tools can be very helpful to crisis management team. But it will be used in addition to specific tools used in each organization, or this type of decision support tools have to consider these specific functions. The question still then: did they have one decision support tool or several dedicated and connected ones? The first experiences, presented in this paper, show different limits of the use of tools:

1. Management team actors will be lost when introducing new tools without any preparation to deal with these tools.
2. Actors tend to use digital tools instead of non-digital ones, considering digital support better than non-digital ones. Digital tools cannot answer all needs. Actors have to be trained to integrate digital and non-digital tools even in stressed situations.
3. Digital tools have to consider different type of habit and usual tasks of different actors coming from different organizations. They have to be adapted to their needs and common habits. For instance, techniques like ERP (which are based on one Data Base and different services adequate interfaces) can be more adequate to help crisis actors to obtain common perception of the crisis and to deal easily with information and decisions.

We present in this paper first studies about the use and the impact of information sharing tools to handle crisis situation awareness. This study has limited by the number of exercises and the crisis management team observations. We plan to extend our observations to other crisis management actors and digital tools. The use of techniques like questionnaires and interviews are scheduled in future work in order to complete our investigations to answer our studies about techniques to support situation awareness in stressed environment.

References

- Belkadi, F., Bonjour, E., Camargo, M., Troussier, N. & Eynard, B. (2013). A situation model to support awareness in collaborative design. *International Journal of Human-Computer Studies*, 71, 110-129. 18, 19, 20, 21
- Carroll, J.M., Rosson, M.B., Convertino, G. & Ganoë, C.H. (2006). Awareness and teamwork in computer-

- supported collaborations. *Interacting with computers*, 18, 21-46. 19
- Dourish, P. & Bellotti, V. (1992). Awareness and coordination in shared workspaces. In *Proceedings of the 1992 ACM conference on Computer-supported cooperative work, Canada*, 107-114. 18, 19
- Endsley, M.R. (1995). Toward a theory of situation awareness in dynamic systems. *Human factors*, 37, 32{64. 18, 21, 22, 23, 24, 25, 28
- Endsley, M.R. (2006). Situation awareness. *Handbook of human factors and ergonomics*, 3, 528-542. 21, 26
- Kulyk, O., van der Veer, G. & van Dijk, B. (2008). Situational awareness support to enhance teamwork in collaborative environments. In *Proceedings of the 15th European conference on Cognitive ergonomics: the ergonomics of cool interaction, Portugal*, 1-5. 24
- Stanton, N.A., Salmon, P.M., Walker, G.H., Salas, E. & Hancock, P.A. (2017). State-of-science: situation awareness in individuals, teams and systems. *Ergonomics*, 60, 449-466. 19
- Shimanski, C. (2008). Situational awareness in search and rescue operations. In *International Technical Rescue Symposium*, 1-12. 25