

Establishing Trust in Critical Situations

Bruno S. Nascimento

Graduate Program in
Informatics

Universidade Federal do Rio de
Janeiro

bruno.nascimento@ppgi.ufrj.br

Adriana S. Vivacqua

Graduate Program in
Informatics

Universidade Federal do Rio de
Janeiro

avivacqua@dcc.ufrj.br

Marcos R.S. Borges

Graduate Program in
Informatics

Universidade Federal do Rio de
Janeiro

mborges@dcc.ufrj.br

ABSTRACT

Critical scenarios, such as emergency response, generally involve groups of people that alternate between collocated and remote work. Groups are composed of small teams and a number of decisions are made while these smaller teams are working separately, in different locations. These decisions may impact not only each others' work, but also team safety and the outcome of the activity as a whole. Decision making in these situations involves a lot of uncertainty and groups have to trust each other to provide crucial information and to carry out orders in the best possible way.

Author Keywords

Emergency management, situation awareness, trust.

INTRODUCTION

According to [4], a virtual team can be defined as a group of individuals working interdependently across space, time, organizational boundaries, and / or work practices through the use of technologies that allow for collaboration achieve common goals. With the growth and introduction of new technologies, virtual teams have become a promising means [10]. These teams have many advantages over traditional teams, including the ability to overcome time and space, and provide better utilization of human resources distributed without physical change of employees [12].

Several studies have shown the benefits of teamwork and indicate that establishing trust between team members is a prerequisite to producing better results. This is because trust functions as a bond that links virtual teams together [12]. However, there are obstacles inherent to this style of work that can compromise trust, generate misunderstandings difficult to detect, and difficult to resolve [4]. According to [11] separation in time and space, the possible absence of a history of shared work, and the limited options of communication channels may eventually make work in

virtual teams disastrous. This concern is echoed in more complex scenarios where virtual teams have little time for decision making.

Emergencies are critical situations that require immediate response to minimize adverse consequences [2]. These situations may be natural or man-made, but require a response to protect life and property [1]. Emergency situations have a broad variability. The same type of situation may lead to different scales of casualties and material damage, depending on social, economic and geographic factors.

In large emergencies, the recovery process may last a long time in these situations, command groups perform strategic planning and make decisions to address the current situation and control of emergency. Response teams deal with the emergency in the front lines, carrying out the strategy designed by the command group. In major events, command posts are usually setup close to affected areas, to increase the information available for decision-making. Proximity to the disaster site, however, does not eliminate the need for correct and prompt situation assessment. Time pressure and uncertainty make it hard to make decisions in these scenarios.

Elements such as speed of events, number of people involved, time available to make decisions, resource availability, situational awareness, pressure and stress are creating challenges to group confidence in complex scenarios. In such cases, group context is an important element, directly influencing the level of trust and determining which procedures should be implemented by team members. The perception of the situation can be regarded as the act of becoming contextualized, or understand the context where the group is acting [13]. Context information can act as a filter that defines the confidence level at a given time, and what procedure should be considered in performing a task.

In this paper we discuss how the oscillations in trust may lead to improvisation (or decision-making not following usual procedures) in complex scenarios. We discuss trust and improvisation in emergency teams, which normally follow a military structure.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

CSCW '13, February 23–27, 2013, San Antonio, Texas, USA.

Copyright 2013 ACM 978-1-4503-1331-5/13/02...\$15.00.

TRUST AND IMPROVISATION IN EMERGENCY-RELATED TEAMWORK

Context has a dynamic nature, as new events arise and new decisions are made, altering the situation. In emergency response, there are many examples of non-routine situations, that affect the team members' confidence in decisions, demanding real time improvisation in procedures. The World Trade Center emergency, for instance, has numerous examples of non-routine scenarios, unplanned that lead to impromptu decision making [11]. Another example is the case of Airbus's U.S. airline U.S. Airways, in which the pilot, due to a possible mechanical failure of the aircraft, opted to improvise, landing in the Hudson River, even though that went against usual emergency procedures [7].

Our research group has a long history in the development of technologies to support emergency response organizations. In these groups, strong hierarchical principles of command, order, discipline and centralized power permeate the organization. These are some of the main principles that form the basis for the Command & Control (C2) structure of the Rio de Janeiro State Fire Department. In this structure, power and responsibility of command rest with a single individual.

According to [5] both in military operations, and in urban activities of emergency response, this structure determines the division of individuals into two categories or groups: Command and Operation. These teams are virtually disjoint but need to work together and share knowledge in order to be successful in their activities.

The information necessary for decision-making in emergency situations may be related to either previous or current knowledge [3]. Previous knowledge is static and stored in maps, databases, plans and in people's minds. Current knowledge refers to contextual information about the situation, is subject to frequent modification and is essential for maintaining an awareness of the situation, which in turn enables decisions making. This information is provided in a collaborative manner, by response teams (usually working at the front lines) to the command post, thus maintaining them informed about the evolution of the situation. External events and the response teams' actions modify the scenario and, hence, the current contextual knowledge.

Communication between teams depends on the situation itself, and usually involves equipment such as: Radio, Personal Digital Assistants (PDAs), Smartphones, Tablet PCs and other devices that can be attached or embedded in uniforms, the so-called wearable devices. The command group is usually located in a room or an outpost, and can query data available at the organization's headquarters, transferring information to operation teams that are working in distinct points in the affected area. The higher the intensity of the disaster, the greater the number of people and organizations working, which makes it difficult to

communicate and manage knowledge, given the large volume of heterogeneous data [8].

An important issue in this process is the low reliability of information in the affected area. Both Command and Operation groups are dealing with situations in which the context is constantly changing, not only due to the environment, but also because of the actions in response to the situation [9]. Moreover, the groups may perceive situations differently, which might lead to different response strategies. This may cause Operations teams to enact procedures that diverge from Command's determinations, and in certain cases, their actions can characterize an unexpected break the hierarchy and in decreased trust between groups.

DISCUSSION

The occurrence of unplanned actions in complex scenarios and the potential breaks on the chain of command, create a need to develop and deploy new procedures in real time [11]. Based on the aforementioned observations, we seek to develop technologies to support work in this type of scenario. Some issues that require further research are: techniques to measure the trust among teams in complex scenarios and situation awareness and its influences on trust in virtual teams in complex problem solving.

Measuring trust in teams

According to [6] trust levels directly influence a team in many ways: the processes of cooperation and collaboration, organizational commitment and morale, flexibility and cost reduction of coordination, knowledge transfer between team members, productivity, decision making processes, communication, the process of innovation and creativity in problem solving, supporting change initiatives, the effectiveness of leadership, labor relations, to name a few. Trust is a vital resource in any team. In a virtual team of emergency response, it is necessary to create indicators that show how much confidence one team or individual has on orders being given by another as that the scenario changes. One way to measure this would be to check the adherence to the recommended procedures by the operations teams.

Situation awareness and trust

One important aspect in emergency-related decision making is situation awareness. Maintaining an awareness of the situation is fundamental to understanding it and making the correct decisions. One frequent occurrence is that operations teams will have different information and a different perception of the situation than command teams, who are frequently remote. Their actions reflect this understanding rather than the command's perception. On the flipside, the command group has a global view which the operations teams lack. Thus, creating a better understanding of the situation on both ends is important to establish trust between teams.

We believe this workshop can provide a starting point for our group to discuss issues of improvisation and trust in virtual groups beyond the current literature and to introduce new ideas, from other domains, into our research. We also believe that our approach for combining contextual awareness mechanisms can be further developed to better support the establishment of trust in groups, showing how actions affect the environment and providing justification for any breaks in command.

ACKNOWLEDGEMENTS

Marcos R.S Borges is supported by CNPq and FAPERJ grants. Adriana S. Vivacqua is supported by a FAPERJ grant. This project is partially supported by CNPq. Bruno S. Nascimento is supported by a CAPES PhD scholarship.

BIO

Bruno S. Nascimento is a full time PhD student in the Graduate Program in Informatics, at the Federal University of Rio de Janeiro. His interests lie in information dissemination in emergency management.

Adriana S. Vivacqua is an assistant professor in the Department of Computer Science, and head of the Graduate Program in Informatics, at the Federal University of Rio de Janeiro. Her work revolves around information dissemination and context aware systems, HCI and CSCW. In the last couple of years, she has been working, in collaboration with Prof. Borges, with Emergency Management, in partnership with the Fire Department and other response agencies. Before that, she collaborated in projects with Petrobras, which included oil rig safety analysis. She is interested in work in critical conditions, especially those that require improvisation.

Marcos R.S. Borges is full professor in the Department of Computer Science, and one of the founding members of the Graduate Program in Informatics, at the Federal University of Rio de Janeiro. He has been working in the field of CSCW for the last 20 years. In the past 5 years, he has been working more intensely in the emergency domain.

REFERENCES

1. National incident management system. Technical report, U.S. Department of Homeland Security, 2008.
2. DHA. Internationally agreed glossary of basic terms related to disaster management. Technical report, United Nations Department of Humanitarian Affairs DHA, 1992.
3. Diniz, V.B., Borges, M.R.S., Gomes, J.O. and Canós, J.H. Decision making support in emergency response. In Encyclopedia of Decision Making and Decision Support Technologies, volume 1. Information Science Reference, 2008.
4. Michell, A. and Zigurs, I. Trust in virtual teams: solved or still a mystery?, ACM SIGMIS Database, v.40 n.3, August 2009. <http://doi.acm.org/10.1145/1592401.1592407>.
5. Engelbrecht, A. Um Modelo de Apoio a percepção situacional na resposta a emergência. MSc Dissertation. Universidade Federal do Rio de Janeiro, Brazil (2011).
6. ECB Project. Building Trust in Diverse Teams: The Toolkit for Emergency Response. Oxford, England: Oxfam Publishing, 2007. <http://www.ecbproject.org/resources/library/17-building-trust-in-diverse-teams-the-toolkit-for-emergency-response>
7. CNN: Passengers report scare on earlier US Airways Flight 1549. In <http://edition.cnn.com/2009/US/01/19/hudson.plane.folo/index.html?iref=allsearch>
8. Careem, M., Bitner, D. and De Silva, R. GIS integration in the sahana disaster management system. In: International Conference On Information Systems For Crisis Response And Management, 4., 2007, Delft, NL. Delft, NL: ISCRAM Community, 2007. p. 211-218.
9. Vivacqua, A.S. and Borges, M.R.S. Taking advantage of collective knowledge in emergency response systems. Journal of Network and Computer Applications, v. 35, p. 189-198, 2012.
10. Ebrahim, N.A., Ahmed, S. and Taha, Z. Virtual Teams: a Literature Review. Australian Journal of Basic and Applied Sciences, Vol. 3, No. 3, pp. 2653-2669, 2009.
11. Mendonça, D.J. and Wallace, W.A. "A cognitive model of improvisation in emergency management", IEEE Trans. Syst., Man, Cybern. A, Syst., Humans, vol. 37, pp.547, 2007.
12. Lipnack, J. and Stamps, J. Virtual Teams: People Working Across Boundaries with Technology, Second Edition, John Wiley & Sons, Inc., New York, NY, 2000.
13. Rosa, M.G.P., Borges, M.R.S. and Santoro, F.M. Evaluation of Contextual Information Influence on Group Interaction. In: Proceedings of the 10th International Conference on Computer Supported Cooperative Work in Design III (CSCWD'06). Nanjing, China, 2006, pp.13-22.