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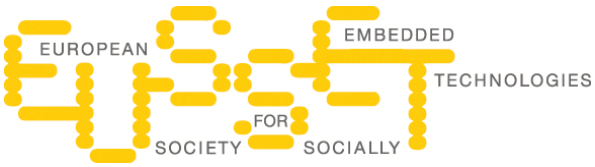


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# Proceedings of 16th European Conference on Computer-Supported Cooperative Work – Doctoral Colloquium

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## Impressum

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# What is the basis for your guesses? Tell us! Sharing Expertise-Based Intuition

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**Abstract.** Expertise-based intuition plays a key role in decision making within organizations. This kind of intuition occurs when the decision maker has developed a rich knowledge from extensive experience. When an expert leaves, he also takes with him his intuition risking the ability of organizations to quickly and accurately make decisions. To support organization to face this issue, we are investigating how to transfer the expertise-based intuition from an expert to a collaborative team and how this transfer can be computationally supported. The research is being conducted following the design science methodological approach. The artifacts generated are a macro process to support sharing intuition and a model to support collaborative intuitive decision making. Our next step is to evolve the macro process detailing it in well-defined processes and highlight what are the collaborative activities and what are their features and requirements regarding the CSCW perspective.

## Doctoral Research Overview

Experts made decisions strongly based in intuition (Klein, 2013). Expertise-based intuition is as a way in which experience is translated into action and plays a key role in decision making especially in complex environments where decisions often have to be made based on dynamic, incomplete and/or contradictory information (Klein, 2013). In these environments, a deliberative analysis is often impossible or inefficient, for example, due to time restrictions (Okoli and Watt, 2018). In contrast to deliberative analysis, intuition is based on the identification of subconscious patterns accessed very quickly by experts (Ross et al., 2004).

An organization should consider that experts eventually leave and take with them tacit knowledge. Part of this knowledge is the ability to apply the expert's intuition when make decisions . Considering that organizations should be prepared

to face these risks, it is important that not only technical capabilities be shared but also the capability of intuitive decision making.

Furthermore, considering that organizations are increasingly globalized and new business model are settling, for example, organizations as open platforms (e.g. uber, airbnb), collaborative teams gain strength in comparison with expert individuals who accumulate and keep knowledge to themselves. In this sense, the use of teams to collaboratively make decisions can bring advantages to organizations. In teams, the knowledge is not in the possession of only one individual, which reduces the risk of great loss of knowledge regarding the exit of one of the organization members. In addition, often collaborative teams outperform individuals in decision making, both in quality and in quantity. During decision making, collaborative teams can more easily parallelize tasks and take advantage of the redundancy of knowledge in the team and the enrichment provided by different views (Huang et al., 2014).

Our research question is: How to transfer the expertise-based intuition from an expert to a collaborative team and how this transfer can be computationally supported? In addressing this question, we expect to contribute to intuition, organizational learning and CSCW (practice-based perspective) research. Regarding intuition research we consider intuition as a mental faculty that allows us to learn from (i.e., to build tacit knowledge from) (van Riel and Horváth, 2014) and consequently to transfer it to somebody. Different from intuition studies that focus on decision making at the individual level, we focus on group intuition. In group intuition, the individual intuitions related to the same decision can be integrated into a collective solution (Akinci and Sadler-Smith, 2018). For example, imagine that an organization has to decide to close or not a certain deal. A team working in this organization composing by members with different perspectives should articulate the different intuitions about this deal and then, collaboratively made the decision. Regarding organizational learning research we are developing a process to support the sharing of expertise-based intuition among experts and teams. Regarding CSCW, we are focusing on developing a computational solution to support expertise sharing (‘people-centric’ view) and also aspects of knowledge sharing (‘object-centric’ view) (Ackerman et al., 2013). We understand that expertise-based intuition sharing is a new proposal both for intuition and organization learning fields and consequently constitutes a new opportunity of application, with new designs and challenges regarding CSCW viewpoint.

The methodological approach considered for the development of this research is the Design Science (DS). The DS methodology aims to produce knowledge about how to design (Dresh et al., 2015). The application of this methodology is not intended to seek optimal results, but rather results that satisfy the problem addressed in the research. Research based on DS proposes solutions to practical problems and also contributes to the improvement of theories.

In our research we expect the conduction of three cycles using DS. In each cycle is expected the generation of an artifact to address our research question and the evaluation of its applicability.

Cycle I provides the development of the general idea of how to share the expertise between an expert and a team. Our theory is that expertise-based intuition can be shared and as consequence the expertise is accelerated. To address the objectives of cycle I the artifacts produced are: a macro process based on models of intuition and knowledge sharing and an initial model to support the use of intuition in decision making considering collaborative teams. For cycle II it is expected to evolve the macro process detailing it in well-defined processes. During cycle II, the processes will be analyzed to highlight what are the collaborative activities and what are their features and requirements from the CSCW perspective. In cycle III it is expected to support the development of an expertise sharing system that considers the collaborative activities highlighted in the processes and its requirements according to CSCW perspective. In summary, after the definition of the collaborative activities, the relationship between these activities and the design of computer artifacts should be settle and then, we should define how to support the cooperative work regarding the complex system where decisions based in intuition are made.

Our work to date is an approach (Neiva and Borges, 2017) that consists of splitting the expert's knowledge and transferring it to a team parallelizing part of the process, thus potentially saving time. This approach was the result of our initial investigation considering the expertise sharing field. We realized that existing techniques to replace and/or train a new expert are not fast enough, especially for those organizations operating in critical areas.

Given that experts apply intuition to multiple actions, a central issue in the approach presented in (Neiva and Borges, 2017) and (Neiva et al., 2017) concerns the development of a similar intuition by the team. In this way, the team should work collaboratively and intuitively to obtain results analogous to those of the individual expert when acting within the organization. In this way, representing the cycle I in the application of the DSR methodology in our research, our paper (Neiva et al., 2018) presents a macro process to support the development of intuition in collaborative teams and a model to support collaborative intuitive decision making. The macro process was built from the combination of the knowledge transfer/creation model proposed by (Nonaka and Takeuchi, 1995) and the conceptualization of intuition as a mental faculty (van Riel and Horváth, 2014). The model, called Collaborative Recognition-Primed Decision Making, was built as an adaptation of the model presented in (Ross et al., 2004) for work explicitly with teams making collaborative decisions. The artifacts generated in cycle I was evaluated through a proof of concept (Neiva et al., 2018).

In a briefly overview of the macro process, tables with decision requirements are inputs into the first stage of the transfer process, which is Socialization. In Socialization a (sub-) process is followed that promotes the discovery of patterns. During Externalization, the patterns identified and discussed with the team are documented and stored forming the initial subsidies for the construction of a collective mental scheme. In the Combination stage, the team works in conjunction with the expert on the construction of decisions based on intuition. At this point, the expert individual is "part of the team". The team organizes the

intuitive decision-making guided by the Collaborative Recognition-Primed Decision Making model. The constant feedback from the expert supports the update of patterns used as triggers for intuition. In Internalization stage, the team internalizes the established patterns by being exposed to the accomplishment of environmental tasks. In this stage, the expert is no longer a "part of the team", he/she tries not to intervene during the decision making, conducting a discussion session only after the decision is made. After the completion of a first round of the process, a new one may begin by considering a new level as a starting point.

Our next step is to evolve each activity in the macro process detailing it in sub processes as defined in our cycle II. In these sub processes the collaborative activities should be highlighted to plan the computer support solution. At the end of cycle II we will continue to the activities defined in cycle III.

# References


Ackerman, M. S., Dachtera, J., Pipek, V., & Wulf, V. (2013). Sharing knowledge and expertise: The CSCW view of knowledge management. *Computer Supported Cooperative Work (CSCW)*, vol. *22, no.* 4-6, pp. 531-573.

Akinci, C., & Sadler-Smith, E. (2018). Collective Intuition: Implications for Improved Decision Making and Organizational Learning. *British Journal of Management*.

Dresch, A., Lacerda, D. P., & Júnior, J. A. V. A. (2015). *Design science research: método de pesquisa para avanço da ciência e tecnologia*. Bookman Editora.

Huang, H. C., Davy, F. L., Shih, H. Y., & Fan, C. J. (2014). Accelerating Knowledge Adoption: Information Systems Change Management. *Approaches and Processes for Managing the Economics of Information Systems*, vol. *253*.

Klein, G. (2013). *Seeing what others don't: The remarkable ways we gain insights*. Public Affairs..

Neiva, F. W., França, J. B., Dias, A. F., & Borges, M. R. (2018). *Agnosco: Transferring Intuition from Individuals to Collaborative Teams*. In press: *Computer Supported Cooperative Work in Design (CSCWD).*

Neiva, F.W. and Borges, M.R. (2017), April. Split expertise transfer: An innovative collaborative approach to support accelerated expertise transfer. *Computer Supported Cooperative Work in Design (CSCWD), 2017 IEEE 21st International Conference on,* pp. 48-53.

Neiva, F. W., França, J. B., Dias, A. F., & Borges, M. R. (2017, October). An innovative approach to accelerate expertise transfer in organizations. In Systems, Man, and Cybernetics (SMC), 2017 IEEE International Conference on, pp. 1770-1775.

Nonaka, I., & Takeuchi, H. (1995). The knowledge-creating company: How Japanese companies create the dynamics of innovation. *Oxford university press.*

Okoli, J., & Watt, J. (2018). Crisis decision-making: the overlap between intuitive and analytical strategies. *Management Decision*.

Ross, K. G., Klein, G. A., Thunholm, P., Schmitt, J. F., & Baxter, H. C. (2004). *The recognition-primed decision model*. ARMY COMBINED ARMS CENTER FORT LEAVENWORTH KS MILITARY REVIEW.

van Riel, A. C., & Horváth, C. (2014). Conceptualizing intuition as a mental faculty: Toward a 'critique of intuitive reason'and a process model of intuition. *Handbook of research methods on intuition*, pp. 42- 67.

*Prébot, Claverie, Salotti (2018): Real-time teamwork evaluation and C2 crisis management: overview of doctoral research. In: Proceedings of the 16th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing an the Design of Cooperation Technologies - Doctoral Colloquium Papers, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.18420/ecscw2018_dc01*

# Real-time teamwork evaluation and C2 crisis management: overview of doctoral research.

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**Abstract.** Evaluation of human performance and cognition has been around for decades. But the growing number of teamwork situations and the growing complexity of military operations and context of command and control of operations have made real time evaluation of team cognition a real need for tomorrow technologies and tools. Being able to assess in real time the individuals and team cognition and state would allow for the development of adaptive tools and systems, gaining in efficiency and performance and lowering errors rate. Our objective is to find appropriate metrics that would allow for such an assessment, in the very constraining context of Current Ops of Air Command and Control rooms, requiring no instrumentation of the monitored operators.

## Introduction

Modern military operations context has changed a lot in the past decades. Conflicts and operations keep getting more complex. The need for a better shared understanding of crisis dynamics is urgent. In the same time, we are facing the multiplication of information sources. The internet of things, social media, drones, etc. can give precious insights, helping create the global crisis dynamics picture needed today. Unfortunately, such an amount of data is overwhelming human operators, threatening to lower the performance instead of improving it.

Artificial Intelligence tools, as well as big data, analytics and cognitive computing will help making sense and extracting valuable intels from those data. In order to be efficient they have to be integrated not as simple tools but as coworkers who thus augment humans by creating a man-machine team. Cognitive assistants (Desclaux et al., 2016), real-time adaptive tools and AI decision support systems involves not only being able to make sense of the data of the situation but also knowing about the state, needs and intentions of the operators and the team.

### Collaboration, C2 and team cognition

Teamwork performance and collaboration is key for modern organizations in charge of civilian or military security tasks. The command and control (C2) domain (military or civil), due to its time-sensitive and collaborative nature, is often used to study collaboration and team cognition. In 2014 HFM-156 working group from NATO Science & Technology Office (STO) published a detailed study on current C2 measurement methods (Berggren, Kermarrec, Banko, Wikberg, & Oleksandur, 2014). From this study stands out the need for developing real-time assessment methods linked to non-invasive psychophysiological methods in ecological environment. These methods, associated with AI tools, would allow increasing real-time agility and efficiency.

## Hypothesis and research questions

When studying team cognition measurement methods, we quickly find that they statistically cluster into 4 meaningful concepts (Berggren, Prytz, Johansson, & Nahlinder, 2011). Workload, teamwork, situation awareness and performance are interconnected and affect one another. According to Berggren, we can formulate our hypothesis in the following way: *The performance of a group can be predicted by a real time evaluation of the workload, situation awareness and teamwork of its members by monitoring them*.

Workload, and more specifically Cognitive workload, and Situation Awareness (SA), are core concepts in human factors and more generally when it comes to assessing human performance and cognition.

Cognitive Workload, refers to the mental effort required by an individual to complete a task, or more simply, the amount of work that an individual can perform at a certain time.

Situation awareness (SA) refers to the understanding an individual builds of the current environment and its surroundings, including a prediction of its future states based on the knowledge of past ones. To sum-up, it is knowing what is going on, and project what may happen (Endsley, 1995). In a team environment, Shared SA (SSA) is the understanding of elements of the situation that two (or more) individuals have to share in order to achieve their interrelated tasks. The

SA concept is central, but due to its subjective and verbal nature, it is not measurable in real-time in an ecological environment. Since Workload, teamwork and SA are linked, evaluating teamwork and workload, which are more easily measurable in real-time, may be a way to detect SA difference between teammates in real-time.

Our goal is to identify metrics that would allow a future system to determine automatically and in real-time if a team is on the same track.
We will address the following research questions:

- Is a difference of understanding of the situation detectable in psychophysiological, behavioral and communication activities of teammates?
- Is the modification of the same metrics of teammates, within a sort timespan, an indicator of shared cognition?

# Work to date

First step has been to identify evaluation methods that would fit with the constraints of C2 ecological context. We looked into human work evaluation methods requiring no equipment of the operator himself that could be done in real-time, without interfering with the task. It also needs metrics and indicators which can be treated automatically.

Identified measurement tools include Eye-tracking, keyboard and mouse activity, and communications recordings.

A first experiment has been conducted late December on students from the Ecole Nationale Superieure de Cognitique. We measured team cognition of 3 teams of 3 individuals playing a command and control game against an AI. Each one of them played 11 games of 20 minutes. We are currently exploiting the data.

In order to validate our hypothesis, we need to:

- Synchronize data sets from every team member.
- Identify key events of the scenarios that affected at least 2 of them
- Identify and compare their reactions to those events in the different metrics
- Look for similarities in metrics modifications in response to a same event.
- Determine combinations of metrics that are statistically the most reliable indicator of the collaboration.

A second experiment with a team of 2 operators with interrelated but different tasks in very controlled scenarios is currently being developed. It is based on DARPA's Warship Commander Task scenarios (St. John, Kobus, Morrison, & Schmorrow, 2004). It will allow us to validate the metrics identified in the first experiment.

# Future steps

Next steps include conducting the second experiment on a larger sample (at least 20 groups of 2). This will be concurrent with an activity analysis on actual C2 operators at Military Air Expertise Center (CEAM - BA 118) and The Air Operations Center of Excellence (CASPOA - Lyon Mt Verdun) to better determine ecological context and constraints. This is important in order to understand how a future monitoring system can be integrated in their work environment in the most efficient way. The system and metrics will then be tested in a large scale exercise in actual C2 context during a real world operation. Two possible exercise have been identified, NATO Trident Juncture exercise and a CASPOA Annual one, both to be held in 2019.

As for future applications, identified metrics if proven successful, will be organized in a Bayesian network allowing to cross metrics to guarantee the result of the measurements. Afterwards, an automated assessment system can be developed or integrated in an already existing cognitive assistant, in order to help detect possible misunderstanding in teams or adapt systems and interfaces in real-time depending on the operator's cognitive state and that of his colleagues.

It is important for us that those results can be transferable to non-military and even non C2 situations. Every sociotechnical systems where team cognition and SA are keys to team performance can benefit from this work.

# Acknowledgments

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# References

Berggren, P., Kermarrec, Y., Banko, K., Wikberg, P. A., & Oleksandur, B. (2014). Measuring and Analyzing Command and Control Performance Effectiveness Mesure et analyse de l ' efficacité fonctionnelle du commandement et contrôle STO-TR-HFM-156, *323*(April), 2014.

Berggren, P., Prytz, E., Johansson, B., & Nahlinder, S. (2011). The relationship between workload, teamwork, situation awareness, and performance in teams: a microworld study. In *Proceedings of the Human Factors and Ergonomics Society 55th Annual Meeting* (pp. 851–855).

Desclaux, G., Claverie, B., Chaudron, L., Le Guyader, H., Salotti, J., & Prebot, B. (2016). Cognitive computing and augmented intelligence in man-system integration: Impact on C2 HQ key processes.

Endsley, M. R. (1995). Toward a theory of situation awareness in dynamic systems. *Human Factors*, *37*(1), 32–64.

St. John, M., Kobus, D. a., Morrison, J. G., & Schmorrow, D. (2004). Overview of the DARPA Augmented Cognition Technical Integration Experiment. *International Journal of Human-Computer Interaction*.

*Mela Bettega (2018): A participatory-based approach to ethical technologies appropriation in a lower digitised fieldwork. In: Proceedings of the 16th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing an the Design of Cooperation Technologies – Doctoral Colloquium Papers, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.18420/ecscw2018_dc03*

# A participatory-based approach to ethical technologies appropriation in a lower digitised fieldwork

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**Abstract.** Socioeconomically underprivileged communities are often disadvantaged by the spread of sharing economy. Projects centred on designing more inclusive and ethical digital technologies do exist but struggle to spread on a large scale. This paper introduces the idea that scarcely digitised environments may be a privileged grounds to facilitate the adoption of alternative technologies, and outline the design of a participatory process to reach this goal in the context of a small Portuguese island.

## Introduction

The term sharing economy is born to describe free exchanges among peers, but in few years has been extended to globally spread, for-profit intermediation platforms (Oh & Moon, 2016). Sharing economy is increasingly criticised for its payout distribution advantaging big investors (Felstiner, 2011) and for downsides mostly affecting already disadvantages categories, and the worsening of working conditions (Felstiner, 2011). On the opposite side, the use of digital technologies to tackle social challenges is spreading as well but, in spite of that, people do not automatically consider the adoption of alternative digital tools also due to the capability of companies to impose themselves as monopolies. The importance of supporting people in making technologies-adoption informed choices (Bødker,

2006) has been already pointed out, but the projects explicitly targeting on this objective are still a minority. From this perspective, scarcely digitised social environment constitute fascinating potential laboratories for alternative future experimentations. I focus therefore on Madeira island as a possible case study where facilitating the appropriation of sustainable digital technologies among the population.

# Socioeconomic structure and digital usage in Madeira

Madeira is a 250k inhabitants archipelago 1000 km far from mainland Portugal. To understand its economic structure and digitisation level, I mainly relied on quantitative data[1], interpreted through one year of informal observations.

Madeira is the second richest region of Portugal (Eurostat) due to the abundance of tourism. Nevertheless, 28% of the population is at risk of poverty (INE-DREM 2014). This situation is probably related to the presence of big-scale touristic industry, characterised by huge accommodation structures owned by few families. This productive structure requires a high number of scarcely qualified workers, and this possibly influences the low education attainment: 61% of Madeirans left school when finishing primary education (14 years old) or even before.

In Madeira, 79% of households have some internet access and is therefore under the European average (85% Eurostat). Observing people in public spaces confirms the scarce digitisation. For example, smartphones are mostly used as old mobile phones. Despite smartphone is the most common digital tool (57% of the population own one) only 37% has a data plan, suggesting the existence of economic barriers to digitisation. Coming to internet use: 75% of the population used the internet at least once in a lifetime (vs 82% of European average), but only 61% use it daily (vs 71% of European average). Coming to digital divide predictors: age, education and income are strongly related to having ever used the internet, but their influence decreases once this first barrier is overcome. Education level has a very strong relationship with having ever used the internet, and a moderate relationship with access to internet and devices.

[1]When not differently specified, information refers to a second level analysis performed on a survey investigating the use of Information and Communication Technologies (INE 2018)

# Research question and expected contribution

My research question is centred on the idea of applying participatory methods to foster the appropriation of ethical digital artefacts. Namely: “How participatory design methods and techniques can foster the appropriation of sustainable digital practices in a scarcely digitised community?”

Determining the contribution of an ethnographic-based research in advance is not easy. Nevertheless, focussing on an entire geographic area, it could be framed as community-based research (DiSalvo et al. 2012), and in case participants will express similar concerns to tackle collectively, it could contribute to the public design (Teli et al. 2015) debate. Targeting the outcomes of ICTs on a disadvantaged community, I hope to contribute to the third-level digital divide (Deursen et al. 2015) discussion. Moreover, the applicative part of the investigation could provide some contribution to platform cooperativism (Scholz et al. 2017) discourse.

# Methodology and next steps

This research can be split into three main activities:

1. The first ethnographic observations supported by second level quantitative data analysis were fundamental to stimulate the current investigation direction. I will therefore proceed with the community study that will allow to identify needs and values that could leverage participation. The analysis of qualitative data will be sided by a quantitative framework that is already outlined.
2. During the core of my research I plan to use artefact ecologies (Jung et al. 2008) within a participatory framework to foster participants in changing digital habits according to their values. I will: I) support participants in designing their current artefact ecologies; II) understand whether there is something that is worth to change; III) support the design of new artefacts ecologies. Workshops and focus groups, will be designed according to participants attitudes and skills (Cremers et al. 2014).
3. An evaluation of the process and outcomes through Bossen's (Bossen et al. 2016) categories. I will consider the PD process as *implementation*; the differences among first and final artefact ecologies will be considered as *output*, and the change of digital habits and its consequences as the

*outcome*. I will involve people with different socioeconomic background, digital skills, and engagement in the project in focus groups and interviews.

In the next months I will adopt more structured ethnographic methods to understand local society, and to find potential participants which I will interview, based on previous observation as well as on literature review insight. The literature review will be restructured according to the themes emerging from the fieldwork in a circular process. Nevertheless, I foresee that appropriation, participatory methods and artefact ecologies will remain its core. Moreover, I will perform an extensive analysis of ethic and sustainable ICT tools and practices.

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# References

Bødker, S. (2006). When second wave HCI meets third wave challenges. In *Proceedings of the 4th Nordic conference on Human-computer interaction: changing roles* (pp. 1–8). ACM.

Bossen, C., Dindler, C., & Iversen, O. S. (2016). Evaluation in participatory design: a literature survey. In *Proceedings of the 14th Participatory Design Conference: Full papers-Volume 1* (pp. 151–160). ACM.

Cremers, A. H., Jansen, Y. J., Neerincx, M. A., Schouten, D., & Kayal, A. (2014). Inclusive design and anthropological methods to create technological support for societal inclusion. In *International Conference on Universal Access in Human-Computer Interaction* (pp. 31–42). Springer.

Carl DiSalvo, Andrew Clement, and Volkmar Pipek. 2012. Participatory design for, with, and by communities. International handbook of participatory design : 182–209.

Eurostat (2017) from https://bit.ly/2i8Xlm7

Felstiner, A. (2011). Working the Crowd: Employment and Labor Law in the Crowdsourcing Industry. *Berkeley Journal of Employment and Labor Law*, *32*, 143.

INE (2018) from https://bit.ly/2ITMcpu

INE-DREM (2014) from https://bit.ly/2GsQPkNy.

Jung, H., Stolterman, E., Ryan, W., Thompson, T., & Siegel, M. (2008). Toward a framework for ecologies of artifacts: how are digital artifacts interconnected within a personal life? In *Proceedings of the 5th Nordic conference on Human-computer interaction: building bridges* (pp. 201–210). ACM.

Oh, S., & Moon, J. Y. (2016). Calling for a shared understanding of the sharing economy. In *Proceedings of the 18th Annual International Conference on Electronic Commerce: e-Commerce in Smart connected World* (p. 35). ACM.

Scholz, T., & Schnider, N. (n.d.). Ours to Hack and to Own. Retrieved 6 October 2017, from http://www.orbooks.com/catalog/ours-to-hack-and-to-own/

Teli, M., Bordin, S., Blanco, M. M., Orabona, G., & De Angeli, A. (2015). Public design of digital commons in urban places: a case study. *International Journal of Human-Computer Studies*, *81*, 17–30.

van Deursen, A. J., & Helsper, E. J. (2015). The third-level digital divide: who benefits most from being online? In *Communication and information technologies annual* (pp. 29–52). Emerald Group Publishing Limited.

*Linot Béatrice (2018): Trust in Computer-Supported crisis management information sharing. In: Proceedings of 16th European Conference on Computer-Supported Cooperative Work – Doctoral Colloquium papers, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.18420/ecscw2018_dc07*

# Trust in Computer-Supported crisis management information sharing

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**Abstract.** My Doctoral research aims to identify the psychological and social factors that influence trust and determine the information sharing behavior of professional participants in the crisis response system. Building on the idea that the computer disrupts these factors, our aim is to design tools that restore the conditions of trust in a framework of collaborative information sharing. I combine theory and methods used in psychology and human factors, with computer science to determine how and why trust is degraded in relation to civil security operations. I propose to (1) identify the multi-level factors influencing trust during collaborative activities supported by computers (e.g., contextual factors, organizational factors, individual factors,); and (2) identify data-based design guidelines for digital devices that promote the sharing of information related to civil security and thereby develop and maintain shared situational awareness during collaborative activities.

## Related Work

France has experienced several disasters in the last decade: Floods (Var, Alpes Maritimes (2015), Seine basin & Loire (2016); Storms Lothar, Martin (1999), Klaus (2009), Xynthia (2010); Terrorist attacks, Charlie hebdo and Bataclan (2015), Nice (2016); the Germanwings crash (2015), explosion of AZF plan in Toulouse (2001). The resulting disorganization and puts a premium on communication between different specialties (e.g. Police, firefighters, medical technicians etc.). Communication between specialties is essential (Quarantelli, 1985). Lagadec (1995) and Dautun (2007) agree with this emphasis on communication, but enrich our understanding of the problem. Because crisis events are unexpected and stress local resources, they often require cooperation among team members who do not know each other and bring different technical expertise, experiences, culture, and organizations.

Groupware systems aim to provide participants with common awareness, i.e., information about the presence, activities, and availability of the other participants in the same system (Bente et al., 2008; Dunaway, Murphy, Venkatasubramanian, Palen & Lopresti, 2017; Xiu, Tredan & Datta, 2014). Yet empirical studies in several domains (e.g., e-banking, civil security, healthcare, military, industries, etc.) reveal low participant confidence in these systems. Additionally, low confidence generates inappropriate behavior (e.g., altering and degrading performance of users technology) reducing use, thereby affecting efficiency. The French tool CRISORSEC is intended to support information sharing among crisis actors. Yet, users question its utility, its form, its uses, its limits and its possible perverse effects. Laurence Créton-Cazanave (a sociologist-geographer), studied CRISORSEC difficulties in French metropolitan areas. Créton-Cazanave, reinforces the link between trust and communication (Cazanave, 2017). Rapport GéNéPi, (2015) echoes the same problems: the technical and tools issues, the communication issues and the organizational issues during crisis situation management. One of the limitations of these studies is the absence of performance data either with or without the assistance of communication tools. I suggest that understanding performance in these different situations informs design requirements.

My pilot data (including 4 visits, 4 observations and 18 interviews) revealed several issues in crisis management collaboration. In particular, several different tools complement CRISORSEC. This strongly suggests that CRISORSEC does not support communication as intended, potentially breaking the link between the source and recipient of information that is maintained in the chosen tools. Identifying (and compensating for) the cause of this drift will improve the design of next generation communication tools. Across the visits, observations and interviews) I noted incidents and malfunctions related to the notion of trust:
- To the tools due mainly to technical malfunctions (18), usability (11) and security (1).
- The data due to characteristics such as credibility and relevance (7), and recency (9).
- The person due to the skills (credibility, experience) of the person you trust (4), and the nature of the relationships, the well-being, and the previous experiences with the other (4).
Technical malfunctions and usability issues will yield to more rigorous engineering. However, the other categories suggest more subtle issues of design and functionality.

# Research questions

A psychological model of communication, including trust, is key to the design of computer-supported crisis management communication tools. My research questions are:

**1) Does mediation by computer for information sharing tools break the adaptive link in communication and thus reduce trust?** The use of alternative communication tools such as e-mail and telephone aims potentially recreates a missing adaptive link in existing tools such as CRISORSEC. In conventional, unmediated communication, the sender shapes the message, taking into account the specific needs of recipient with respect to his tasks in a global plan. Participants trust other participants to provide important information. If observers omit detail, recipients are justified in assuming that the omitted detail is not relevant. The sender may specify schedule, data characteristics, and situation that determine the activity of the recipient. I will examine the use of alternative means of communication (phone calls, sms, secure email, etc.) despite tool availability:

- Presence, number and objectives of parallel exchanges (e.g., verification, cross-referencing, questions of relevance, recency, reliability of information, interpretation);
- The lack of use of information (Not taken into account and retention of information);
- The lack of sharing (on the sharing tool) of known information (sharing or not information, validation of information by the hierarchy);
- Development and use of a parallel tool in lieu of the common tool of sharing.

**2) What is the role of context in establishing trust?** During crisis response trust is a building process, depends mostly on contextual than individual and organizational factors. To support this claim, I must examine all three potential influences:
- Individual (propensity to trust, experience, domain expertise, perceived risk, task goals).
- Local context (the seriousness of the situation, the level of risk, distributed and mediated work? update and relevance data, context situation, etc).
- Organizational context (formal responsibilities, management structure, existing communication tools and practices).

# Methods

The goals is to obtain performance data concerning the factors that influence the decision to accept or distribute information. I seek convergent, ideally quantifiable evidence to address the above research questions. Psychology and ergonomics provides three general methods to gather data while minimizing experimenter bias: observation, interviews/surveys and experimental tasks. The study participants staff Crisis intervention, in crisis cells triggered for a given event (e.g., from CODIS, CORGN, CRRA, prefecture, CIC, COZ and COGIC); and includes professionals such as (fire-brigade, civil security associations, staff of the SAMU, gendarmerie, police, prefecture, military, and other partners). The proposed work will be conducted in two phases: Phase 1 largely concerns realistic crisis response activities, including observation and interviews. Phase 2 concerns largely experimentally contrived tasks, which provide both quantitative and qualitative data.

*Phase 1-step 1: "Crisis exercises" Observation:* Observations will be conducted in simulated crisis response in the French territory. Data collection includes participant written responses, video/audio recording, photographs and/or experimenter notes. In contrast to a traditional ethnographic exercise, I seek evidence regarding the ebb and flow of trust.

*Phase 1 Step 2: Self-confrontation interviews (post-observation):* Purely observational data may not reveal the intentionality considerations behind the observed information sharing. The goal of follow-up interviews is to obtain explanation concerning the factors that influence the decision to accept or distribute information. *Phase 1 Step 3: Critical Incident interviews:* One of the problems with observational study is that the conclusions are dependent upon the particular sample observed. In complex domains, this sample is highly likely to be biased. The critical incident technique is designed to facilitate the study of unobserved events, incidents or processes that the subject has previously experienced as significant, to clarify how they have been managed and the resulting effects.

*Phase 2 Step 1: Incident Sorting:* One of the limitations of Phase 1 activity is the confounding of data with particular participants and the absence of a domain analysis that integrates the data. Card sorting allows participants to group incidents according to an abstraction hierarchy of similarity. Phase 2 will use Phase 1 data develop a systematic set of

scenarios concerning the sharing of information. Analysis identifies the terms, concepts, key words and actions inherent in the characteristics that distinguish those situations that foster trust in the sharing and exchange of data between different civil security services.

*Phase 2 Step 2: Situational Judgment test (survey):* My final method provides the best opportunity to obtain large scale evidence regarding a standardized set of operational conditions. A variety of Situational judgement tests concerning information sharing scenarios, informed by all of the above resources, will be distributed in the form of a questionnaire to professional civilian security on a larger scale. Of particular interest is the consistency or variability in response.

# Expected contributions

- Examine the extent to which trust issues pervade current communication tools.
- Establish the main factors that build trust in the information sharing activity.
- Specify the essential contextual factors that favor conditions of trust and more particularly for the design of collaborative sharing tools.

Understanding mediated and unmediated communication will contribute design requirements for the next generation of crisis communication tools and more generally groupware systems.

# References


Bente, G., Rüggenberg, S., Krämer, N. C., & Eschenburg, F. (2008) : Avatar-mediated networking: Increasing social presence and interpersonal trust in net-based collaborations. *Human Communication Research*, *34*(2), 287-318. DOI: 10.1111/j.1468-2958.2008.00322.x

Créton-Cazanave, L. (2017) : L'application *Crisorsec*, un dispositif numérique au coeur des enjeux de la gestion des crises en milieu métropolitain. *Sociologies pratiques*, 34,(1), 83-92. doi:10.3917/sopr.034.0083.

Dautun, C., (2007) : Contribution à l'étude des crises de grande ampleur : connaissance et aide à la décision pour la Sécurité Civile. Thèse pour obtenir le grade de docteur de l'Ecole Nationale Supérieure des Mines de Saint-Etienne.

Dolidon, H., Renou, T. (2015) : Granularité des niveaux de pilotage. Cahier des charges, SP1 : Cas d'utilisation, besoins et recueil de connaissance. *Agence Nationale de Recherche*.

Dunaway, M., Murphy, R., Venkatasubramanian, N., Palen, L., & Lopresti, D. (2017): Research Agenda in Intelligent Infrastructure to Enhance Disaster Management, Community Resilience and Public Safety*,* arXiv:1705.01985.

Lagadec P. (1995) : « Cellules de crise », les conditions d'une conduite efficace.

Quarantelli, E. L. (1985): Research Findings on Organizational Behavior in Disasters and implications for disaster planning. Preliminary Paper 107. Disaster Research Center (Report Series 18), University of Delaware, Newark, Delaware.

Xiu, L., Tredan, G. & Datta, A. (2014) :A Generic Trust Framework for Large-Scale Open Systems using Machine Learning". *Computational Intelligence 30*(4), 700–721.

*G. Beaudon (2018): "Modelling customer experience in insurance: Context-System-Trajectory Theory". In: Proceedings of the 16th European Conference on Computer-Supported Cooperative Work: The International Venue on Practice-centred Computing an the Design of Cooperation Technologies - Doctoral Colloquium Papers, Reports of the European Society for Socially Embedded Technologies (ISSN 2510-2591), DOI: 10.18420/ecscw2018_dc06*

# Modelling customer experience in insurance: Context-System-Trajectory Theory

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**Abstract.** My doctoral research is about modelling customer experience in insurance. Analyzing new insurers' problematics with in the third French mutual health-insurer has emphasized the customer experience as a relevancy and complex subject. This application will describe our exploratory interviews methodology, our first finding: a new theoretical framework to analyze customer experience (our object), and considered next steps.

## Doctoral research

### Research questions

French health-insurance market is completely transforming. From 1156 in 2006 to 560 in 2014 (Juilliard, 2016), mutual health-insurers dropped to 446 in 2016 (Perrin, 2017). Regulatory constraints upset market's rules. More and more aggressive non-mutual healthinsurance actors enter this market. At last, the need for customer personalization grows up. Offering relevant and omni-channel customer experiences is becoming a necessity. Nevertheless, in order to offer omnichannel personalized services, insurers must transform their organizational

structure as well as their business models. Additionally they have to improve their digital systems and take advantage of real time data via connected objects. This doctoral research main hypothesis is the misalignment of these components: organization, business model, service relation, data and information system. It needs a unified theoretical framework, an analysis methodology and even finally a computing definition. Together, it allows handling customer experience in the digital environment. Our preliminary intuition is that within customer experience domain, a new information system trajectory is organically linked to the dynamic structuration of customer's trajectories. In other words, relationship between information system and actor's activity is an "entanglement" matter (Orlikowski & Scott, 2008). In the field of Information System research in Management Studies, and based on the concept of relations from Latour's and Law's actor-network theory (ANT), (Orlikowski, 2007) claimed "the constitutive entanglement of the social and the material in everyday organizational life." This entanglement presumes that there are no independently existing entities with inherent characteristics. The central argument insists on dealing with the social and the material in the same register, and not reverting to a limiting dualism that treats them as separate phenomena. Thus, our main questions are:

- describe Customer Experience Management System and user engagement entanglement and Trajectories (states) of the entanglement of the objet (Customer experience);
- model Customer Experience with an original construct that we called Context-System-Trajectory (CST);
- define a contextualizing artifact that measure system and context trajectories jointly and thus states of the object (Customer Experience) relying on service interaction (Schneider, 2016) unit of analysis;
- elaborate an application to model service interaction ground on an adapted service system model ISPAR from (Maglio et al., 2009) called NISPARO (**N**ew event, **I**nteraction and **S**ervice **I**nteraction, **P**roposal, **A**greement, **R**ealization and **O**utcome) using machine learning techniques.

## Methodological approach

During two months (November-December 2017) we conducted fifteen exploratory interviews. Interviewees came from various insurer business units – Product Development, Marketing & Sales, Policy Administration, Customer Management and IT – and different hierarchical level – strategic, management, executive and experts. Each interview lasted one and half hour. All have been transcripted. The result showed three main topics: innovation process, strategic context and disruptive insurance approaches. We analyzed them with interpretative methodology leading to more than twenty disruptive approaches. This process has confirmed and highlighted some of our hypothesis:

- Customer experience is a strategic aspect of business transformation and have relevant digital dimension;
- However one of the major issue is to consider this phenomenon beyond its marketing dimension;
- Finally, it is difficult to conceive relationship between information system and human activity according to a Sociomaterial Entanglement design pattern, rather than distinguish two elements interacting, and thus ontologically divided.

Then, we follow (Moschetti-Jacob, 2016) for whom the creation of an artifact answering the complexity of customer experience handling in digital environment is a relevant approach. We create an artifact based on Design Science Methodology (Hevner and al., 2004) – the "contextualizing artifact" –. This one is grounded on commitment/engagement (Becker, 1960; Thevenot, 2001) and trajectory (Strauss, 1992) concepts. We aim to design cross-channel customer experience to develop managers' capabilities and help them reduce the complexity of customer experience management.

## Work/findings to date

According to our methodology we settled an artifact to the customer experience management domain, and specifically the capture of Context. This Context limits the number of possible states a System could occupy. Thus, we focus on the representation of contextual data that describes the state of a system within a given Trajectory. Henceforth this represents what we call "contextualized artifact", which is a computing management tool that professionals can use to reduce the complexity of customer experience management.

Therefore our contextualized artifact rests on a double hypothesis:

- customer experience information system and consistency activity journeys constitute one single process, according to imbrication perspective (Leonardi et al., 2012), the "intra-action" theory (Barad, 2007), and the entanglement and information system sociomateriality (Orlilowski, 2007 ; 2010 ; Orlikowski and Scott 2008);
- the System/Trajectory pattern makes Context the joining element between System and Trajectory. So, our contextualized artifact could be positioned within the triplet Context/System/Trajectory concept also call CST theory.

To develop our theory we to conceive a new computational framework for customer experience information system. We thought an application to collect, interpret and analyze interactions services as a service system model called NISPARO adapted from (Maglio et al., 2009). Our primary conclusions rely on multiple arguments. First, the trajectory (states) concept (Oiry and al., 2010) is relevant to analyze customer experience management system entangled with customer engagement journey. Secondly we defined that user Engagement has

spatial - a situated coordinated action - (Thévenot, 2001) and temporal - linked decisions from the past - dimensions (Becker, 1960). Thirdly we develop the CST theory to articulate information system and engagement trajectory related to a contextualizing artifact. This artifact reduces the complexity of customer experience management by outlining state's system with contextual data

## Next steps

This section presents our main next steps as we started this project on November 2017. First we have to refine CST theory improving our object scope and definition. Context, Engagement, Interaction and Trajectory as mains concepts have to be clearly settled. Second, our field of study has to be refined in order to outline our artifact's testing users. Currently we consider, according to La Mutuelle Generale committee, our thesis positioning at a marketing management level. But it appears that other business units - Product Development, Sales and Customer Management - will be immediate recipients Last considered step to ground our theory is observing interaction services (Schneider, 2016) within different using situation involving IT tools. At this point we just have Salesforce data without context observation. It is unsatisfying to qualify computer supported work problem. As discussed, these steps are main ones. Other exploratory works are considered such as conceive an interaction mining application and a customer experience data visualization. Our challenge here will be the datasets available in health-insurer information system. It is the key to realize previous steps and step back to analyze real managers' practices.

## Expected contributions

We expect that our work change insurers' manager views on customer experience. It reveals customer experience complexity beyond its marketing dimension. With CST theory we have a tool to analyze initial situation of customer experience information system versus the targeted one. It exposes a disruptive framework for sensing, interpreting and analyzing interaction services contextual data.

# References

Barad, K. M. (2007): *Meeting the universe halfway: quantum physics and the entanglement of matter and meaning*. Durham: Duke University Press.

Becker, H. S. (1960): Notes on the Concept of Commitment. *American Journal of Sociology*, vol. 66, no. 1, July 1960, pp. 32-40. https://doi.org/10.1086/222820

Hevner, A.R., March, S.T., Park, J., Ram, S. (2004): Design Science in Information Systems Research. *MIS Quarterly*, vol 28, no. 1, March 2004, pp. 75–105.

Juilliard, M.-P. (2016) : Une concentration des mutuelles inéluctable... ou presque. *L'Argus de l'assurance*, (N° 7451). From http://www.argusdelassurance.com/acteurs/une-concentration-des-mutuelles-ineluctable-ou-presque.105324

Leonardi, P. M., Nardi, B. A., & Kallinikos, J. (Éd.). (2012): *Materiality and organizing: social interaction in a technological world* (1st ed). Oxford: Oxford University Press.

Maglio, P. P., Vargo, S. L., Caswell, N., & Spohrer, J. (2009): The service system is the basic abstraction of service science. *Information Systems and E-Business Management*, vol. 7, no. 4, September 2009, pp. 395-406. https://doi.org/10.1007/s10257-008-0105-1

Moschetti-Jacob, F. (2016, décembre): *Création d'un artefact modulaire d'aide à la conception de parcours client cross-canal visant à développer les capacités des managers des entreprises du secteur du commerce* (Thesis). Paris-Dauphine.

Oiry, E., Bidart, C., Brochier, D., Garnier, J., Gilson, A., Longo, M.-E., … Tchobanian, R. (2010): Propositions pour un cadre théorique unifié et une méthodologie d'analyse des trajectoires des projets dans les organisations. *Management & Avenir*, vol. 36, no. 6, pp. 84. https://doi.org/10.3917/mav.036.0084

Orlikowski, W. J. (2007): Sociomaterial Practices: Exploring Technology at Work. *Organization Studies*, vol. 28, no. 9, September 2007, pp. 1435-1448. https://doi.org/10.1177/0170840607081138

Orlikowski, W., & Scott, S. (2008): The entangling of technology and work in organizations. *Working paper series, Dept of management information systems and innovation group*, vol. London School of Economics, January 2008.

Orlikowski, W. J. (2010): The sociomateriality of organisational life: considering technology in management research. *Cambridge Journal of Economics*, vol. 34, no 1, January 2010, pp. 125-141. https://doi.org/10.1093/cje/bep058

Perrin, G. (2017): Santé : la baisse du nombre de mutuelles se poursuit. *L'Argus de l'assurance*. From http://www.argusdelassurance.com/acteurs/mutuelles-de-sante-ip/sante-la-baisse-du-nombre-de-mutuelles-se-poursuit.120613

Schneider, A. (2016): *Handling the clash between production & consumption. A situated view on front-line service workers'competencies in interactive service*. Rainer Hampp Verlag.

Strauss, A.L. (1992): *La trame de la négociation: sociologie qualitative et interactionnisme*. Éditions L'Harmattan, Paris.

Thévenot, L. (2001): *The Practice Turn in Contemporary Theory*, Chapter 'Pragmatic regimes governing the engagement with the world', Knorr-Cetina, K., Schatzki, T. Savigny Eike v. (eds).