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The Missing Piece to the Crisis Management Puzzle: Making the Best Decision

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Abstract The field of emergency preparedness and response has been driven recently by training efforts utilizing software based technology to mitigate and respond to potential and/or actual crisis situations. Yet, despite this effort, numerous research findings highlight the failures of both disaster and emergency agencies as well as private sector organizations in dealing with both major disruptions as well as local emergencies. We argue that a critical missing piece to rectify such failures, particularly in the training process, can be attained by refocusing on organizational processes toward preparedness/response with greater attention being paid to the context of how decisions are actually made and who makes them.

This critical missing element in preparation/response will be addressed here by laying out how data analytics associated with real-time behavioral decisions during an earthquake simulation can be utilized in optimizing the decision making process. This will provide a window into why protocols are not adhered to or how informal social networks within organizations are critical elements affecting decisions. To delve into this organizational reality, an emphasis will be put on not only the human factor in decision making but the organizational context within which interaction among and between employees takes place that affect how and what decisions are made.

Keywords: Crisis Management, Decision Making, Data Analytics, Social Networks

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1. INTRODUCTION

The sheer cost in lives and property due to a wide range of disasters across the globe has increased the urgency to reevaluate how to best be prepared as well as effective means to respond. This cliché downplays the fact that most organizations – both in the private and public sector – are not prepared nor able to respond effectively (Alesch *et al*. 2001; De Smet *et al*, 2012). A closer examination of private sector organizations reveals that the majority lack or have outdated disaster/crisis protocols. Agencies whose prime objective is dealing with disasters and emergencies, while having protocols in place, have been found to be lacking in the ability to mitigate and/or respond to complex crisis and/or disasters.[4]

So how do employees get it right when an external crisis or internal organizational disruption suddenly occurs? For the most part they don't; critical organizational knowledge from both training and actual experiences seems to dissipate quickly and even forgotten (Beazley *et al*. 2003)! Recent studies have found that in the case of emergency and disaster agencies, there is even a trend toward repeating the same mistakes (Brady 2018). And, despite varied recommendations on organizational learning and alternative "training courses" to improve on mistakes, the modern bureaucratic disaster/emergency organizations as well as many private sector companies rarely introduce alternative means of improving performance during a crisis. What seems common in addressing this chronic issue is by increasing budgets for more employees, material assets and highly visible technology; along with more detailed protocols determining how and what decisions need to mitigate a crisis. In large part, these changes are focused on internal organizational needs so as to maintain continuity and organizational viability. Despite these actions, as has been noted, the number and costs in dead and injured as well as material loss has continued to increase. To understand why this happens, We argue that the key lies in the decision making process, particularly when protocols for action can sometimes disregard reality and/or are modified to fit organizational functions and administrative directives rather than find solutions to potential crisis.

1.1 Organizational Protocols

To better understand this argument, it is crucial to point out that protocols are at the very heart of complex organizations, especially organizations providing specific services such as emergency or disaster services (Bruinsma & De Hoog 2006). Protocols reflect the power and administrative structure of the formal organizational hierarchy, thereby determining the flow of communications and operational procedures. Protocols can been seen as a critical set of rules that define and determine the effectiveness of the response as well as reflect the degree to which an organization is prepared. In an ideal setting, protocols – when followed – should provide

[4] Recent studies have even shown a positive link between increased numbers of disaster agencies (and allocated budgets) to increase numbers and cost of disasters. (Kirschenbaum 2004). This counterintuitive link certainly makes one wonder how it is that agencies whose goal is to be prepared for and respond to disasters are not meeting expectations!

the optimum results. However, protocols were developed under certain sets of assumptions and administrative constraints that tend to reflect the stated goals of the service organization rather than what is best needed in cases of emergencies and crisis. In addition, protocols reflect the rigid bureaucratic formal structure of organizations while excluding informal social networks that are core elements of an organizations' activities.

1.2 Social Networks as an Alternative

Over the past 75 years, scholars of organizations have repeatedly noted that organizations are composed of both a formal (*e.g*. organizational chart) structure as well as an informal structure reflecting sets of relationships among its members. These social networks are consistently generated and renewed at all levels of an organization. Most scholars have argued that organizational process and performance are influenced more by the informal social networks than formal protocols (Huning *et al*. 2015) This, it appears, occurs in even the most bureaucratic type of organizations – *e.g*., military based rigid hierarchies of which emergency and disaster agencies are typical. In contrast to formal protocol driven decisions, informal social networks often bypass administrative rules and regulations by having access to communication channels built on social networks of friends and/or work mates whose opinions and abilities are perceived to be more effective in dealing with both typical and/or unusual types of disruptions or emergencies. These informal networks have been studied intensively and are alive and well, sometimes despite the ardent efforts of administrators to suppress them.

The link between the informal social networks and the formal organizational structure when decisions related to disruptive events occur both within and outside the organizations are complicated. On the one hand they are not an integral part of the organizational protocols but on the other play an important role in how decisions will be made. This is especially true when both time and resources are constrained or limited. The complications occur when disasters or emergencies are evolving or cascading – involving unexpected collateral disruptions or situations when protocols are inadequate. What seemed a much focused event suddenly becomes a multi-casualty event: when an electric outage puts computer dependent organizations on hold, disrupts vital infrastructure, transportation and chain supply access flounders. What may begin as a clear cut standardized organizational protocol driven set of decisions can evolve very quickly into "but the protocol doesn't account for this" "and "what should we do"?

1.3 Disruptions and Decision Making

In such a situation, decisions involved in preparing for a crisis may lead to a collapse of the organizations ability to provide services, and will certainly affect decision making during an actual crisis. We argue that dealing with a crisis is therefore not a 'cut and dry' copy-paste procedure that relies solely on following protocols. A significant component involved relies on

the "soft belly" of organizations, namely the informal social networks inherent within them. Empirical studies of how formal communications protocols are supplemented and sometimes bypassed via informal social networks are well documented and demonstrate how such networks can (and have) been effective in dealing with crises (Kirschenbaum & Rapaport 2018). This means that a potential influence on decisions depends on how, when and the intensity of employees interacting with each other, creating conditions of who trusts whom, and even affected by links to someone outside the administrative chain of command who can help. In short, informal social networking generated within and outside the organization are clearly intrinsic to how decisions are made. If this is the case, how can decision making be improved when the focus strays from the prescribed protocol? Experts on organizational behavior and/or strategic management suggest the solution is 'training' and 'practice' as it offers many advantages to the decision making process and bolsters the organizations employee's ability to deal with disruptions.

1.4 Preparing Through Training

As pointed out, a cardinal rule for emergency or disaster organizations is to be prepared.[5] By being prepared brings with it more effective decision making and creates the conditions for a better response. Underlying this assumption is the issue of what and how best can an organization be prepared for a variety of crises? And how to best prepare the organization's members to deal with immediate emergencies or disasters that may extend over time. Excluding the physical and material needed, the traditional method for being prepared has relied on practice through exercises. Training manuals abound as do companies specializing in either skill enhancement or emergency/disaster management; but they rely on existing protocols that follow the administrative lines of decision making and communication threads. Some are more realistic than others, particularly when moving from table-top exercises, field exercises to Virtual Reality simulations, but little exists in actual comparative studies (Hsu *et al*, 2013). Studies have proven that exercise training does work by reducing mistakes and increase efficiency but it is unclear how much better or effective it is in contrast to a lack of training (Kroll & Moynihan 2015).

Research points out that in technical areas (particularly routine medical or mechanical actions), training is effective. Under "normal" organizational processes, training usually increases performance but it is not clear if it does so during a crisis – especially as each type of organizations may require differing sets of training objectives. What these studies suggests is that training effectiveness depends on the type of organization, the type of job profile and the type of person involved and finally the type of disruption or emergency. Most importantly, if training focuses only on protocol decision making and disregards the informal social networks

[5] This applies not only to organizations but families as well. Studies suggest that being prepared not only increases the odds of saving lives but also reducing costs of material loss of property and infrastructure.

of communications inherent in these organizations, decision making in a crisis, emergency or disaster can evolve quickly into inaction and/or disruptive operational priorities.

1.5 Training as an Interactive Process

Empirical evidence of decision making in areas ranging from airport security (Kirschenbaum, 2015) to bystander behavior (Kirschenbaum & Rapaport 2018) points out that decisions made by individuals are rarely made without taking into account others. For example, as emergency/disaster protocols are incorporated into an organizations hierarchy, it would seem only natural that each "cog" in the structure would need to make his/her own decision as determined by the protocol and then pass these decisions along the administrative chain. This assumption, when examined empirically, is only partially correct as it fails to report the extensive interaction of its members in informal conversations within and across departments and even organizations during the decision making process (Hossain *et al*. 2013). These interactions reflect informal social networks within organizations and have been found to comprise a significant part of how decisions are made. To map these informal communication channels is difficult as they are dynamic (but not random) and tend to be contextually socially determined. Contributing factors to the density of social networks include physical and social proximity as well as the characteristics of those involved, trusting behaviors, friendship/family ties, seniority, past experience with crises and even racial/ethnic biases toward 'others'. Taken together, these attributes affect employee interactions and how decisions are made within the organization but there still remains the issue of what effect intervening factors such as training and in particular the use of technology may have during this process.

1.6 Technology in Crisis Decision Making

From medieval apprenticeship to its modern version of 'on job training', various types of training has been a key form for effective job related decision making that improves performance. It applies to simple routine tasks as well as critical policy decisions and certainly organizational preparedness for emergencies and disasters. The most recent use of training for various crisis has been in applying war gaming programs employing scenario simulations; either table top exercises, video presentations or virtual reality Drumhiller *et al*, 2021). For the most part such training continue to follow the protocol trail where decisions are guided by pre-set administrative rules. In addition, most are formatted as physical or computer table-top type simulations. This does not mean that decisions made during these exercises are not complicated or require selection among multiple choices but the decision paths remain within set protocols; with only a very limited number of (pre-planned static) scenarios that lack the flexibility to change scenario situations during a crisis or disruption scenario. More simply, this rigidness in most cases does not reflect the reality of the changing situations that occur during actual emergencies/disasters nor the non-rational behaviors of the actors.

If we look more carefully at the training sector and its links to software technology, we find a host of recent developments that to a large extent mirror advances in human resource management, particularly in terms of increased productivity through team efforts based on various training and exercise systems (Hendy 2021). Add to this advances in video gaming and simulation software. In general such advances are less visible in the private sector which views investment in such training as costly in terms of time lost and potential loss of revenue despite probable risks of disruptions in providing services. In the public sector, especially agencies that deal with disasters and emergencies (including military and emergency /disaster preparedness agencies), such training exercises are an integral part of the organizations operational structure.

1.7 Embedding Real-Time Processes

For both private and especially public sector crisis/disaster service agencies, protocols are usually a required (regulated) prerequisite prompting the utilization of training programs. While the assumption that a crisis may evolve due to natural events (*e.g*., earthquakes, extreme weather), technological (including cyberattacks) or human made (*e.g*., fraud, embezzlement, accidents) factors, it is the internal organizational decisions made that will impact on the response. Such a response is based primarily on complex decision-making processes under extreme conditions of uncertainty. As a consequence, preparing the response for a crisis is paramount to an organizations continuity. The challenge, however, is how to prepare effectively, both in terms of cost inputs and performance outputs while providing decision makers with the most accurate, updated and constant information for optimal decision making.

In addition, only few organizations are likely to put in place real-time process monitoring systems and manual audits for running various assessments, which are aimed at triggering crisis indicators.[6] Accordingly, they also set procedures and protocols specifying the planned actions that must be done in order to handle the situation. One flaw emerges despite these advanced technological/software solutions, namely these systems and procedures do not take into account the human factor – non-rational behaviors, emotions, conflicting choices and experience – that are present in decisions and actions before, during and after the crisis event/s. These "non-rational" factors are generated and enhanced from within informal social networks which, as been noted, are an integral part of the organizations structure.

It is important to emphasize that the decision making process within the organization depends on behaviors of employees, managers and senior executives- who are the bedrock in organizational crisis response. Together they have an immediate potential effect at mitigating crisis at three levels: (1) *Individual level* - perceiving and realizing what is happening, or being fully aware of the situation; (2) *team/ unit level* - connecting with other employees; (3) *response level* - making decisions to minimize the damage and/or solutions to fluctuating situations. All

[6] Somewhat similar alternative monitoring systems have been used that usually analyze social media information but tend to focus on evaluating external impacts of a disaster event.

these behavioral decisions – at times non-rational –are potentially imbedded in a response organizations workforce, and key in determining whether the organization will successfully manage the threat of, or actual, emergency/disaster.

1.8 Technology as a Potential Solution

Being prepared and providing an effective response are strongly interrelated. Before the crisis, at the preparedness phase, the critical question is if the organization will be able to evaluate the adequacy of response procedures, and optimize the abilities of the responders – managers and employees – to respond. In addition, during a crisis, will it be possible to monitor the progress in achieving particular planned and pre-defined *key performance indicators* (KPIs) that are critical for achieving recovery from the crisis. It is possible that software technology may help achieve these goals?

The reality is that procedures and plans – even after traditional training exercises guided by training software scenarios- do not ensure an optimal response during real-time non-routine and/or crisis events. In order to react immediately, decisively and adequately, the reality of human behaviors must be analyzed and integrated in the planning and real-time functioning of the organization. This means that there is an option to utilize technologies such as artificial intelligence (AI) and Big Data analysis (BD) to develop human behavior analytics which will, together with organizational data, provide insights for optimizing organizational response decisions to a crisis, mitigate/limit damage while increasing organizational metrics and total performance (Nunavath & Goodwin 2019). This, we argue, can be achieved by gaining a greater understanding how decisions are made and incorporating them into training programs.

This "ideal" means to achieve such a goal – given present advances in software – can be envisaged as a digital application that analyses decision makers' behaviors before, during and after real-world events and through this means predict an organizations' goal attainment through realization of pre-defined crisis mitigation plans. During uncertainties or crisis events, various types, sources and intensity of information becomes a vital component that can affect decision making. When situations arise requiring decisions that are complex and sometimes extreme due to a short timeframe or when multiple stakeholders are involved, understanding such behavior, and especially how it is derived, is critical. The "ideal" digital application would then be able to improve an organizations' crisis preparedness and management by providing insights into how decision evolve which can then decrease uncertainty in the decision making process.

In metaphoric terms, this means that organizations' crisis plans and procedures will now become "living, breathing" procedures which will have the ability to change and adapt continuously based on simulated real-time scenarios of actions taken by those involved decision makers. The process will become a virtual "rehearsal stage" ecosystem in which managers and employees will be able to tweak their processes, practices and behaviors (within

the self-contained, failsafe environment of computer games) and understand how specific changes would impact departmental and organizational management protocols, before attempting such changes in reality.

This approach, when applied, should enable organizations to understand how their plans and procedures look and work- visually- and what this means for their teams and operations; it will allow organizations to practice managing various emergencies/disasters and contingencies using customized simulations based on their own procedures and incorporate unexpected events.

2. EXPANDING PRESENT TECHNOLOGY

The development of a digital training program that emphasizes human behavior analytics incorporating a simulator platform and a type of procedure editor exist but is in its infancy. For the most part these simulations are narrow in scope and focus on very specific areas of disaster or crisis events; particularly in areas of medicine, logistics and evacuations. However, to be effective, we argue that such training programs built around simulations, would need to widen their scope and focus more on *Human Behavior Analytics* that should include at least the following measurements which are summarized below.

i. Synergy-web maps – map the frequency and intensity of communications between individuals and teams (who in the organization talks to whom, when they talk, what they share, how frequently.

ii. Individual situational perception analysis – measures capabilities for individuals and teams to attain accurate understanding of shifting conditions and scenarios (do workers and manager understand how does the situation evolve? Do they understand that something unusual is happening?);

iii. Content and text analysis – analyses the use of language to assess individuals' and teams' evolving emotional states and perceptions (do they use professional pre-defined language? Does stress emerge from their communication?);

iv. Performing players – measures individuals' levels of influence on other individuals and on the management of scenarios (do certain worker or managers enhance actions of, or, from others, *i.e*. influence them to lead, initiate/follow the situation?);

v. Protocols, or Standard Operating Procedures (SOP) compliance – measures discrepancies between practices/behaviors from SOPs and identifies the reason behind the diversions;

vi. Rule conformity vs. Adaptation – identifies the level of (individuals' and team's) alignment with their "rules" (procedures, regulations, minimum standards/requirements,

etc.) compared to their abilities to perform above and beyond the parameters of these rules. Who do they report to? From whom do they accept information from?

2.1 Simulating and Catching Reality

As already noted, a large proportion of training simulations for crisis or disasters are simplifications of reality and reflect protocols of the formal organization administrative structure. In cases where a crisis falls outside the expected set of well-rehearsed training protocols, structured preparedness may even hamper those making decisions in finding a solution. This situation can be avoided by building on existing organizations' procedures and structures but through customized crisis simulations. This can be done through a graphic representation of management processes - identifying influential personnel, their state of mind and specific procedures' pressure points where decision making is disrupted, extracting decision-making trees and detecting discrepancies between the organizations' expected performances and simulated behaviors.

To do so requires a *Process Monitor,* a digital tool that will enable the organization to understand if it is progressing effectively towards achieving its Key Performance Indicators (KPI).[7] This can be accomplished through an analysis of the behavioral data and actual performance. The tool should have the ability to examine the organization's progress in reaching pre-defined KPIs which are critical for the entire organizational response. This will alert decision makers when there is a risk of failure to achieve the KPIs while engaging in simulations involving complex decision-making processes including the very real possibility that other factors might be changing simultaneously, *e.g.*, supply-chain disruptions. For disaster agencies, this would include both competing invasive (*e.g.*, NGO's) and allied (*e.g.*, environmental, regulatory) organizations as well as market share for private sector production and/or service industries.

2.2 Monitoring the Decision Process

The development of a *Process Monitor* will enable the organization to compare between three types of organizational processes and outcomes on the basis of human behavior analytics. These include:

a. Expected behaviors (how decision-making within the organization was expected to be carried out via protocols in case of a crisis),

[7] The development and execution of these simulations was done in coordination with a private company (www.cinten.com) engaged in providing such services to a broad range of organizations. Permission was given to reproduce these results under the condition that full privacy of the clients was assured.

b. Predicted behaviors (what the organization has done in the past in cases of other similar crises, unusual events, simulations and/or table top exercises),

c. Real behaviors (what the organization's members do in real-time events).

To accomplish this, there is need of utilizing Artificial Intelligence techniques that will learn from previous data) – how certain decisions are made; when there are deviations from the expected process, how they managed to achieve KPIs, finding common denominators that lead to KPI achievement as well as the impact of disruptions/distractions in KPI achievement. The system will be able to learn how organizational members behave/respond to different "what-if's" in their processes, thus creating a matrix that is able to predict achievement of these KPIs in real time.

All three types of processes measures are devised to be able to analyze and track human behavior (including actions and decisions) over time, including: who does what; who interacts with whom and when; what type of information flows are associated with which interaction; what should be done, by whom and when; how are communications channels created between different global and/or local units; usage of professional lingo, signals of situational awareness and adaptive behavior vs. adherence to protocols.

The uniqueness of this process is in its collation of behavioral data across multiple levels and channels; analyzing processes, performance and behavioral data on three basic levels where the software collates data on the organization as a whole, on the group level (comprised of a number of people from either within or between departments or functional units) as well as on the individual level; providing actionable insights into multiple layers of performance. The system can then fuse these three aspects and use the outcome to design a tailor-made simulation that, through use of sophisticated statistical tools, can forecast individual and group behaviors and decision-making, thereby driving organizations to successfully manage the risks, threats and crises to which they are vulnerable. Thus, the purpose of the paper is to show how data analytics associated with real-time behavioral data on decisions during an earthquake simulation can be used to optimize decision-making processes.

2.3 The Behavior Differentiator Dashboard

Having organizational members perform the simulations while simultaneously recording and analyzing the observed decision making behavior will lead to a critical part of evaluating the ability to mitigate or solve a crisis, namely what can be designated as a 'Behavioral Comparison Dashboard'. The dashboard can be envisioned as an interactive, digital, multi-tiered organizational map that visualizes qualitative and quantitative behavioral data trends at individual, group (inter/intra departmental) and organizational levels. The dashboard will create critical path models and will map gaps between (planned versus achieved) process monitoring. Through presentation of multiple layers of data, these models and maps will enable

organizations to understand which specific components of which processes, practices, and behaviors should be modified for more efficient and/or effective outcomes. Because these maps will be based on an AI engine, they will provide practical explanations of the implications of adjusting the components, including how the adjustments will impact the larger organizational plans, processes and performance. Of critical importance to the decision-making process is that the output is continually being provided to the organization's members during the scenario session and that its final results only minutes after the training completion.

3. METHODOLOGY - ANALYTICAL FORMAT

The general format – outlined below reflects a broad based model for taking advantage of AI and Big Data type analyses associated with simulation training that is aimed at flushing out the decision making process during a crisis, be it internal or external to the organization. This model incorporates all of the elements discussed above.

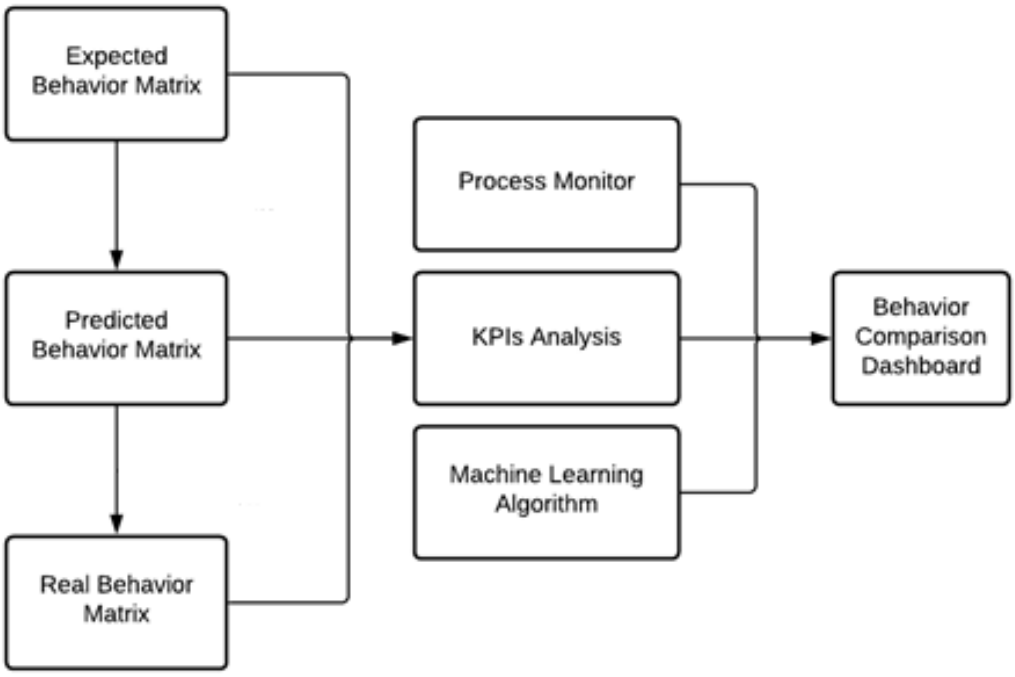

Figure 1. Analytical Model for Deriving Expected and Actual Behaviors

4. SUPPORTING CASE STUDY RESULTS

The above arguments which are transcribed into the Analytical Model encompassing behavioral aspects of crisis decision making now allows us to test this perspective. It is both a means of providing proof of concept and empirically testing a basic propositions that formal

administrative organizational protocols in a crisis provide only a partial picture of how decisions are made. To do so, a large number of case study simulations was generated across various organizations and reflected diverse types of potential crises related to each's core activities.[8] For the purpose here, a case was chosen typifying the general methodology employed with a focus on how various agencies (players) dealt with the decisions involved in a simulation dealing with an earthquake.

Expected vs Actual Levels of Activity

The organizational protocols that determine which players will be involved in a crisis decision may be in place or taken for granted by an organizations members. This, we have argued, may have little to do with actual behaviors that affect decisions. To this end, we can note below that measures of the simulation clearly show *actual* intensity of activities (Figure 3) along a time line by those involved (*e.g*., emergency management agency, Ministry of Transportation, *etc*.) do *not* match what the players had expected (Figure 2) to happen.

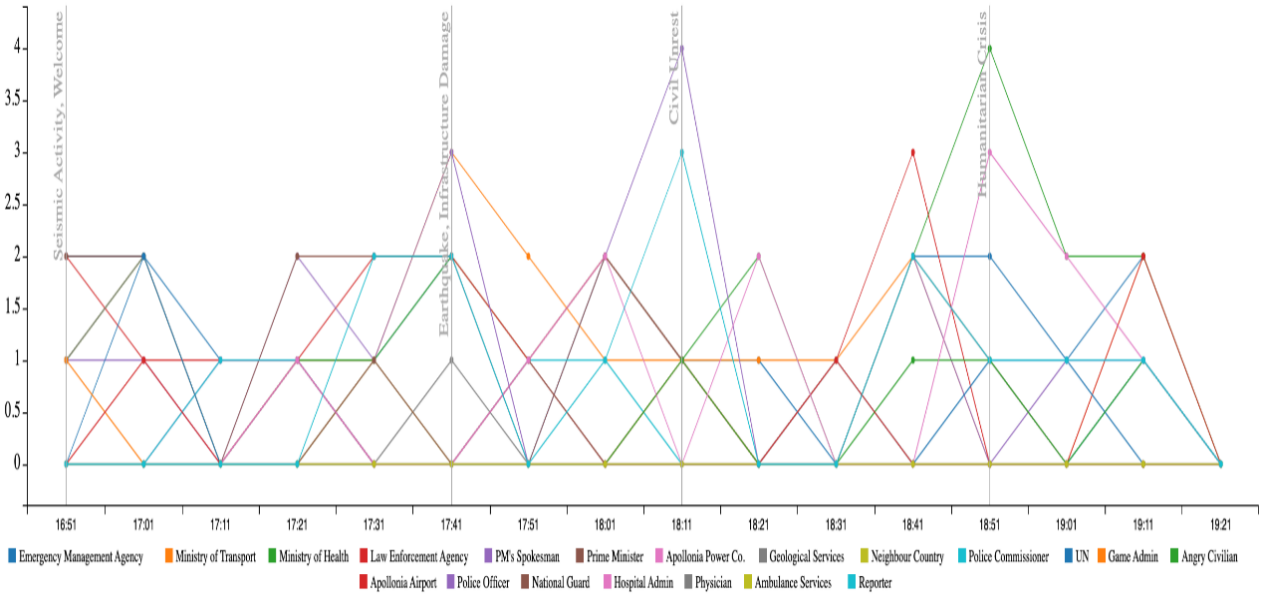

Figure 2. Expected Intensity Map
(participants' expected levels of activity - according to the procedures uploaded to software)

[8] The development and execution of these simulations was done in coordination with a private company (www.cinten.com) engaged in providing such services to a broad range of organizations. Permission was given to reproduce these results under the condition that full privacy of the clients was assured.

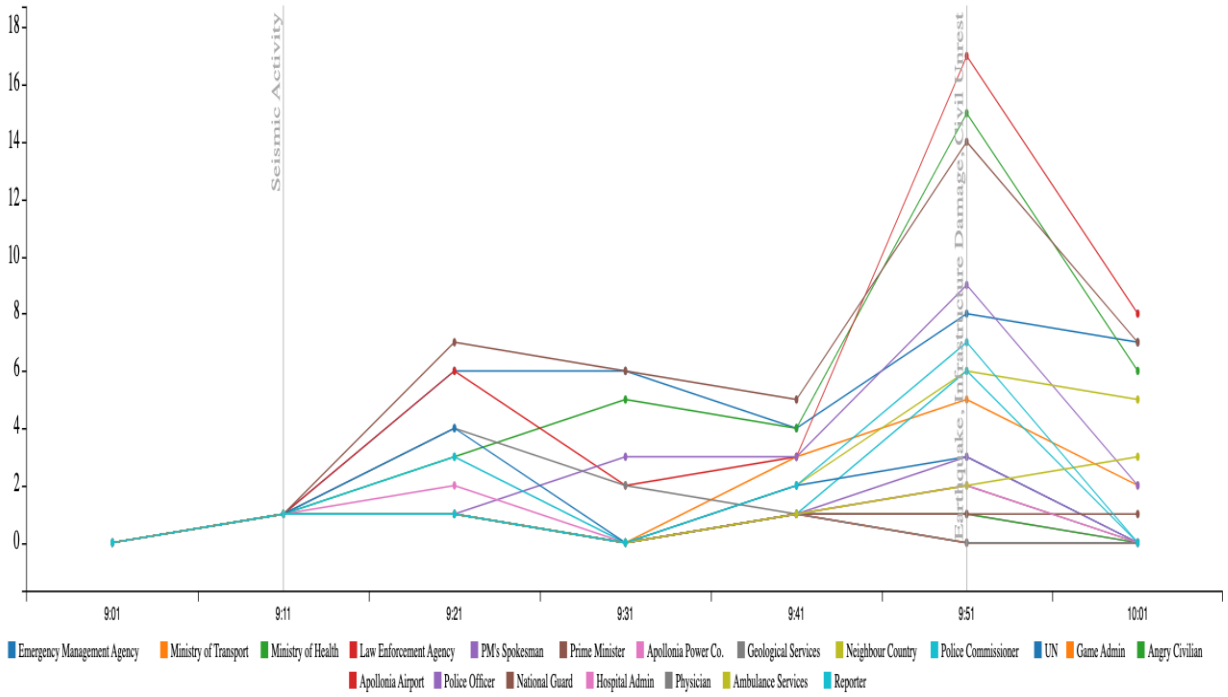

Figure 3. Real Intensity Map
(participants' real levels of activity – according to the performance of the simulation)

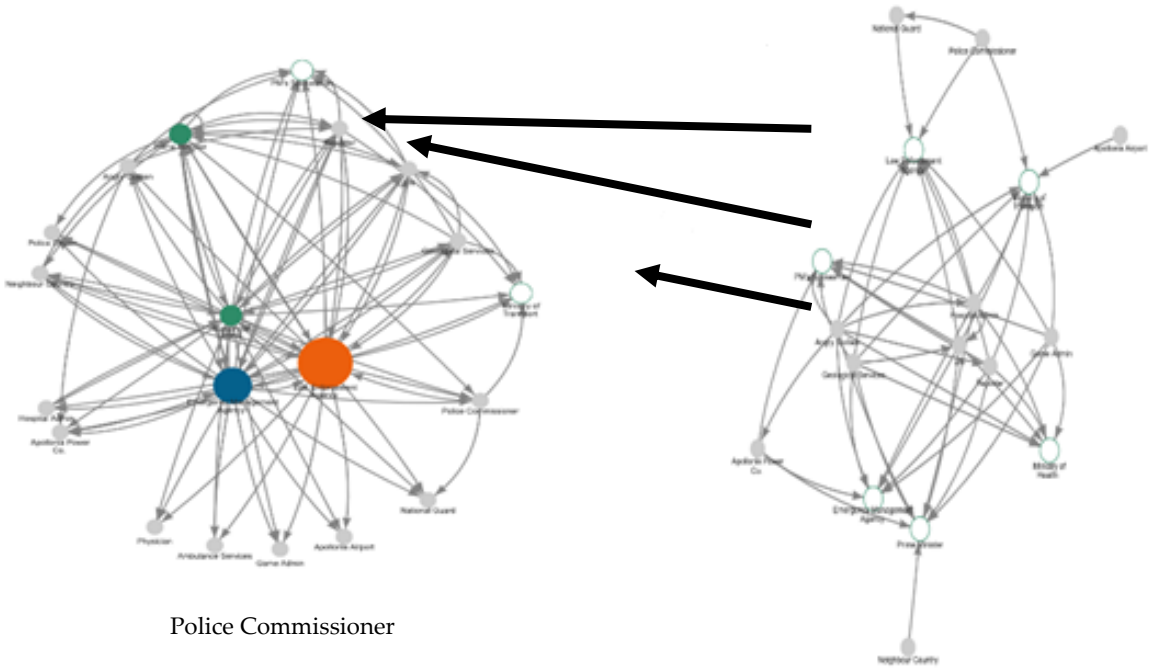

Figure 4. Expected (right figure) vs. real (left figure) interaction maps

Interaction Patterns

The outcome of the analysis that provides a picture of who interacted with whom as well as indicating the differential intensity of the interactions is seen in Figures 3. This intensity of interaction map clearly shows the difference in the structure of the expected (right figure) and the real (left figure) interactions and the gap between the official formal lines of communications and the actual networks that are utilized. They also provide a picture of the informal types of social network communications that go outside the formal administrative protocols that are an integral part of the decision making process during a crisis.

Decision Influencers

By utilizing these actions it is also possible to gain insights into who are the key influencers. This can be seen when comparing output from Figures 5 & 6.

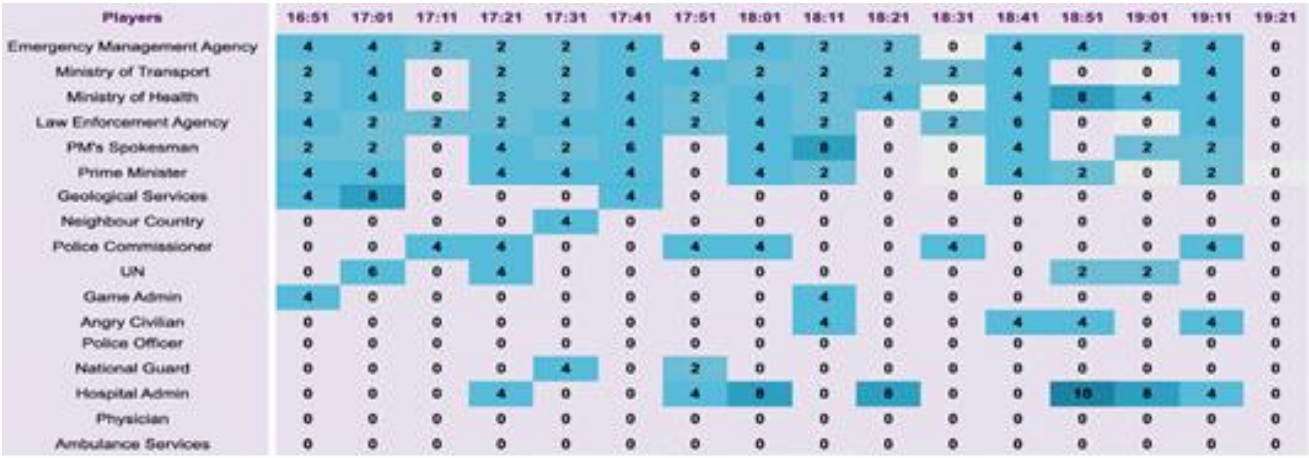

Figure 5. Expected Heat Map
(participants' expected lines of communication - according to the procedures uploaded to software)

Figure 5 provides the number of times that players in the simulation are expected to interact with their counterparts in resolving the earthquake scenario along a time line. If we examine how these interactions actually occurred during the simulation (See Figure 6), several critical pieces of information arise. For one, the expected distribution of mutual consultations based on the organizations formal administrative protocols between players does not take place. On the basis of the intensity and direction of communications, certain players (agencies) apparently wield greater influence than others (*e.g.*, Ministry of Health and Law Enforcement Agencies, Prime Minister) concerning how and what types of decisions will be made, particularly as the crisis proceeds along a time line.

Players	9:01	9:11	9:21	9:31	9:41	9:51	10:01
Emergency Management Agency	2	4	14	16	10	18	18
Ministry of Transport	0	2	2	0	6	10	4
Ministry of Health	0	2	10	16	8	42	18
Law Enforcement Agency	0	2	18	4	8	44	24
PM's Spokesman	0	2	2	6	6	18	4
Prime Minister	0	2	14	16	10	36	18
Geological Services	0	2	12	6	2	6	0
Neighbour Country	0	2	2	0	6	16	12
Police Commissioner	0	2	8	0	2	16	0
Police Officer	0	2	2	0	2	6	0
National Guard	0	2	2	0	2	2	2
Hospital Admin	0	2	2	0	2	6	0
Physician	0	2	2	0	2	0	0
Ambulance Services	0	2	2	0	2	4	6

Figure 6. Real Heat Map
(participants' real lines of communication -according to the performance of the simulation)

Figure 7. Real word Map
(participants' real words' usage during of communication - in the simulation

Conversations, Words and Unexpected Events

The ability of the analytics to capture conversations (via emails, chats, *etc.*) also provided a window into exploring how the crisis decision making evolved and developed. Figure 7 represents the distribution of words that are used in the conversations along time by their intensity (number of times stated) among the players. The larger the font, the greater the use of the word. In our case, the term "earthquake" appears at the very beginning of the crisis simulation with other action items and focal points appearing at critical junctures along the decision making process. The use of "words" can therefore be an important gauge of how the decision making process develops and the focus that decisions and eventually actions will take.

As a component in the Behavioral Analytic Model (See Figure 1), unusual and/or unexpected events occurring during a crisis that need to be addressed can also be taken into account. To do so, such events were appropriately introduced during the simulation through the use of embedded announcements in the form of questionnaires. The responses provided another piece of evidence of the variety of responses among the players (*i.e.*, agencies) and through its analysis led to changes in the ongoing simulation scenario. As an example, Figure 8 describes the results when players are asked to respond to the question "How would you advise your constituents regarding evacuation?" The "pop-up" was placed at a point in time when it was accepted by all players the extent of the earthquakes damage. From the responses, it is clear that there is a divergence of decisions of how to deal with the evacuation option that would affect how other types of decisions would be made.

Figure 8. Response to Unexpected Events through Embedded Questionnaires

5. CONCLUSIONS

We have argued that a missing piece in crisis management that has not been fully taken into account are the behavior of those involved in how decisions are made. While most simulation training programs are based on the formal organizational protocols, I have shown that actual behaviors do not always comply with these rules.

Crisis, whether within an organization or induced by external events, requires specific decisions to be made under, at times, extreme uncertainty and time pressure. By having the

ability to expose and differentiate decision making channels during highly sophisticated and realistic scenarios, allowing the organizations members to immediately decipher who interacts and influences whom, the output of the training process can generate a detailed picture of the decision making process within the organizations.

By utilizing powerful AI tools, some of the most intriguing internal decision making networks can be unveiled and used to inform an organizations members what went right or wrong; consequently providing a springboard for more effective use of the process of crisis management and in addition, enhancing the ability to secure key performance indicators (KPI). This same process can be utilized for many other types of cases where decision-making is the foundation for variety of policy actions that include both public and private sector organizations. The simplified case study presented involving an earthquake scenario illustrates that there is the possibility to go beyond the present scenario training process by actually opening up the critical decision processes that are the heart of how organizations' members can more effectively find solutions to a large variety of crisis.

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