

# THE ROLE OF INFORMATION AND COGNITIVE DOMAINS IN EMERGENCIES

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DOI: <https://doi.org/10.31410/ERAZ.2020.259>

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**Abstract:** *This report discusses the role of information domain and cognitive technologies in emergency management in the context of the global pandemic problems, which is also caused by a lack of leader's capacity, knowledge transfer, lack of major investments in the security and health systems. Global emergency response plans should be based on the "artificial" reality of our planetary condition and used as a starting point for planning. Innovative companies are trying to take advantage of cognitive technologies to automate processes to solve a wide range of problems that require specific knowledge. The main aspects of knowledge are related to the so-called „P" categories (Perceive, Perception, Predict) of our critical environment and data input to such systems coming from sensors and smart elements. The new model for effective reactions in crisis refers to cognitive technologies, which, if available use an aesthetic language, generate unstructured texts, process information, used sensors for data in real-time, reading signals, access to "smart objects" and other algorithmic approaches for searching of solutions in extreme situations. The cognitive technologies used during contingency planning is oriented towards the further development of AI in order to improve the performance of machines in terms of intuition, sensitivity, emotions, and other factors that enhance the planning and decision-making tasks.*

**Keywords:** *Information domain, Cognitive computing, Emergency planning, Crisis communications, Knowledge transfer, Machine learning, Infodemics.*

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During the epidemics and crises, information is the most valuable resource, it is more important than any symbolic form of isolation. Upon receiving accurate information on the speed and nature of the epidemic decisions become more relevant to realities. The speed and extent of the threat are directly dependent on the interpretation of information. The ruling political elite also showed in Europe's inability to cope adequately with complex problems caused by the viral epidemic, in the months of February and March (2020). After that, the measures taken to deal with the situation were the same, untimely, chaotic, and rather symbolic. In such situations, it is required to radically change the management model and temporary replacement of political elites, with people who have the training to handle extreme situations effectively to protect the lives of citizens. In critical moments, we need politics and decisions based on scientific data. In the pandemic like the present, we can talk about the construction of simulated reality and so-called by experts „infodemics". A „snowball effect" or one dominant theme continues for months and discredits reality as such. All the facts, news, comments in the public (online) space are related to the epidemic-that way a lot of facts are accumulated, related to only one problem, on the one hand, and on the other, the lack of professional analysis and interpretation of the situation leads to distorting the situation.

## 1. SIMULATED REALITY ABOUT THE PANDEMIC

Benjamin Bratton<sup>2</sup> told us that the sense of extraordinary and unusual is tangible and real. Instead of calling this moment an ‚exception state', we should look at it more as a ‚prior state'.

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<sup>2</sup> See also: Benjamin H. Bratton <https://strelkamag.com/en/article/18-lessons-from-quarantine-urbanism>

The consequences of poor planning or lack thereof are destroying social systems and isolating reflections become apparent. Vigilance should be oriented not to „exceptions” as correct, recognized norms of behavior, but above all, to the emergence of such dysfunctional norms once the horizon is clear.

Characteristics of reality in the first months of 2020:

- physical threats,
- database related to only one problem,
- cascading online effect,
- reality is replaced by simulated reality,
- game model, addiction to a common theme, unifying people’s thinking,
- lack of effective ideas to tackle the problem / global teams for defining problems are deficit,
- key public hubs and places related to mass culture and the values already formed,
- in the past 20 years there is no comprehensive ideas to deal with such situations,
- by that time we are witnessing massive investments in sports, shows, entertainment industry,
- limited investment in security systems, crisis response and prevention.

### 1.1. Emergency principles

In this epidemic, current governments in Europe have shown complete incompetence. Basic principles of emergency management have been violated. There is an effect called „isolation hysteria”. Factors that have characteristics to complicate situation: globalization; urbanization; huge metropolitan areas; lack of teams to identify potential problems; poor preparation for emergency and crisis management; the role of civil protection is underestimated; intensive air traffic all over the world.

Eric Klingenberg<sup>3</sup>, professor of sociology and director of the Institute for Public Knowledge at New York University pointed out that the coronavirus pandemic marks the end of our romance with market society and hyper-individualism. We could turn toward authoritarianism. The dystopian scenario is real. However, we will go in the other direction. We are now seeing that market-based models for social organization fail, catastrophically, as self-seeking behavior makes this crisis so much more dangerous than it needed to be. Nevertheless, crisis moments also present opportunity<sup>4</sup>: more sophisticated and flexible use of technology, less polarization, a revived appreciation for the outdoors and enjoyment in other simple pleasures.

Ben-Israel<sup>5</sup>, who also heads Israel’s Space Agency, said: the policy of lockdowns and closures was a case of “mass hysteria.” Simple social distancing would be sufficient. Professor Yuval Harari<sup>6</sup>, during the one interview point out that humankind is now facing a global crisis. Perhaps the biggest crisis of our generation. In such moment, we must act quickly and decisively.

<sup>3</sup> Coronavirus Will Change the World Permanently.  
<https://www.politico.com/news/magazine/2020/03/19/coronavirus-effect-economy-life-society-analysis-covid-135579>

<sup>4</sup> Ibid. Coronavirus Will Change the World Permanently.

<sup>5</sup> <https://www.timesofisrael.com/top-israeli-prof-claims-simple-stats-show-virus-plays-itself-out-after-70-days/>

<sup>6</sup> Prof. Yuval Noah Harari: The world after coronavirus  
<https://www.ft.com/content/19d90308-6858-11ea-a3c9-1fe6fedcca75>

We should also take into account the long-term consequences of our actions. Decisions that in normal times could take years of deliberation are passed in a matter of hours. In this time of crisis, we face two particularly important choices. The first is between totalitarian surveillance and citizen empowerment. The second is between nationalist isolation and global solidarity. According to Harari instead of building a surveillance regime, it is not too late to rebuild people's trust in science, in public authorities and in the media. We should definitely make use of new technologies too, but these technologies should empower citizens. He also concludes that both the epidemic itself and the resulting economic crisis are global problems. They can be solved effectively only by global co-operation. We need a global plan of action, and we need it fast.

Populism says prof. Bratton<sup>7</sup> despises experts and expertise, but right now people desire competence. At this moment, dry, prepared, trustworthy, available, adaptable, responsive technocratic foresight and effectiveness seem like the most idealistic politics imaginable. What is required is less a new narrative or a new art than acceptance of how the rapid intrusion of an indifferent reality can make symbolic resistance useless. The pre-existing conditions now exposed clarify the need for a geopolitics based not on self-undermining prisoner's dilemma tactics in the face of common risks, but on a deliberate plan for the coordination of the planet we occupy, make, and re-make over again. Otherwise, this moment really will be a permanent emergency.

Bratton<sup>8</sup> pointed out that the most successful steps have robust empirical and predictive model simulations of the situation and use these as a tool for action. City centers have become human-exclusion zones. We are uncomfortably adapting to psychogeography of isolation. Quarantine means a kind of suspended indeterminate status. As the RNA code of virus hacks our cells, it starts a domino effect of consequences, altering not only the movement of people, but affecting planetary cycles of energy, materialization, expenditure, and waste. This conclusion to be drawn is not that global interconnection is a bad idea, or a good idea, but that it is intrinsic and runs deeper than conventionally realized. Our thinking and our interventions must be based on a higher resolution understanding of cyclical interrelations and physical economies, from scales of viral infection to intercontinental circulation and back again.

## 1.2. Emergencies development

In the contemporary critical situation the governments take an actions with one-month delay / basic rule, if you are only a few hours late, everything you do is inadequate in this case / all measures are taken out of movement and in fact, as a result of which the results are more than tragic. For example, in March 2020, thousands of people have returned to Bulgaria from risk zones, they are potentially infected with the virus, or the virus was brought from outside with the help of government, they control borders, not people. In addition, authorities did not take steps to isolate and test people at airports in special hospitals; from this point of view, we cannot expect the situation's improvement.

Another opposite example is South Australia region with very few confirmed infections cases (438), and 96% are recovered. One of the hallmarks of their response has been strong border restrictions. Early border control was effective in restricting the number of cases and after that; they have the highest level of testing. The same approaches and models for the management of

<sup>7</sup> See Benjamin H. Bratton 18 Lessons of quarantine urbanism  
<https://strelkamag.com/en/article/18-lessons-from-quarantine-urbanism>

<sup>8</sup> Ibid

situation the expert notice in New Zealand, as a result, they have extremely low fatalities and in Vietnam, the fatalities rate close to zero.

Methods are important and timely response. If the actions in the first days are inadequate / as it was in the our country and other European countries - a delay of more than a month / all other decisions lead to more tragic results. High levels of the incompetence of the administration have a big impact to society, they are not ready to react in such situations, everything was perceived as a show.

Social distance is the distance between the carriers of the virus and a healthy person, and sometimes it is calculated over several tens of kilometers, and it is very naive to believe that 1-2 meters is enough. This means an accurate diagnosis of infection and treatment at the point of detection. At the moment, the situation is very risky and complex, affecting various areas - the economy, business, social sphere, movement of people, most things are related to logistics, this implies that the processes are controlled by people who have been trained in this type of management, not under the authority of medical workers who never learned such things.

A well-informed population and motivation alone are more important and more effective than controlling people through police measures, ignoring their participation in decision-making. Unfortunately, in the current pandemic situation, the authorities have no information about what happened, they have "0" information about the threats.

### **1.3. Communication in the risk and emergency situations**

Typical risks for the modern man are:

- Increasing population density, abnormal crowding in major cities and metropolitan areas.
- Population increase in high-risk areas resorts / Thailand / along the large rivers / Danube /, coasts of oceans, mountains.
- Strengthening the role of technological risks - new technologies - new unknown risks.
- Population Aging - Risks and vulnerability to new infections and epidemics, special services to assist the elderly. One third of the European population is over 65 years, 2.5 million pensioners in Bulgaria.
- Emergence of new high-resistance treatment risks. Humanity has faced a variety of epidemics such as cholera, plague, influenza, typhoid, malaria, smallpox, with tragic results and millions of casualties.

Crisis communications: can be defined in two ways and therefore the concept causes confusion among experts. Today, the term is used to describe an organization in crisis and the need to communicate in this situation with key groups and audiences. Usually a crisis is an event that occurs unexpectedly; the organization is unable to control it, causes a loss of trust in management, and threatens reputation. Crisis communications provide primary, factual information to people. They are intended to inform the public how to evacuate in case of danger. The crisis is still a situation where control is minimized and happens without the involvement of the organization. Communication in a problematic situation - it is like crisis communication, but here the organization has knowledge of the situation and the ability to choose the time to discover its plans to overcome the problem.

Emergency communications-oriented to act in a disaster environment when it is necessary to inform people about the risk and benefits to shareholders and the public. The communicator, in

this case, is not perceived as a participant in a crisis or disaster, except that he is perceived as a mediator trying to resolve the situation. Communications are also aimed at informing people about possible solutions, with limited time and the threat to nature's health. Decisions are made, often with inaccurate and unclear information. This type of communication provides the opinion and knowledge of experts, allowing people to take appropriate action and respond adequately to a rapid disaster recovery. The effects from current epidemics are not disaster for business from crisis management point of view.

Elements of successful communication are: accuracy of information; high speed; openness; reliability and trust. Tasks of a critical situation are:

- Be prepared in advance,
- Partner search and expertise,
- Developing consensus on global responses,
- Database preparation and information flow management.

#### 1.4. Communications in the emergencies

Five approaches<sup>9</sup> to disaster that can block communication:

1. Too many messages from different experts and agencies: The problem arises when many organizations, agencies, provide different answers about the disaster. In times of crisis, people want the best solution and what it now. That is, they need a common version, suggested by different experts, of what to do right now.
2. The information for emergency is late. When epidemic started, the WHO recommended that only the diseased should wear protective masks, then the requirements are for everyone. If we do not provide the information that people need, then another will provide it, in another form, and it may prove fatal.
3. Paternalistic attitudes: „Don't worry." Tell citizens what they need to know to make their own decisions.
4. Beware of the rumors - they arise in the absence of quality information about the hazard. Establish a system for monitoring the media and public response to public information. Do not spread rumors with press conferences / i.e. not to hold press conferences for every hearing that has occurred. If the rumor is on the internet, only respond there.
5. Collision and conflict between different agencies about what happened. People need clearly defined roles and responsibilities.

Important steps to Communicating Success

- Clear communication plan - this plan is as important as any other plan.
- Becoming the first source of information in a crisis - the first message has more weight; however, it is dangerous if the first message is incorrect and fact-based.
- Express empathy for people - feel their feelings. The audience wants to know to what extent the administration understands their fears and needs.
- Demonstration of competence and expertise. Research shows that most people tend to believe in individuals who hold a particular professional position.
- Staying honest and open to the public: The danger arises when agencies try to protect people in order to avoid bigger problems by hiding information from the public. In the age of the information society, it is difficult to hide the facts or limit the flow of information.

<sup>9</sup> See: Crisis and Emergency Risk Communication, Barbara Reynolds, 2005, Centers for Disease Control and Prevention, Atlanta, Georgia

Conditions to be met by the first crisis messages and announcements:

- expressing empathy,
- confirmation of the facts (who, what, where, when, why, how), but it is not necessary to answer all these questions,
- what we do not know about the situation,
- explain to people when they will receive the first answer,
- what kind of assistance the citizens expect: commitments (we will provide you with information again in an hour); not to promise things beyond our control,
- where people can get more information (providing an open telephone line, a website for questions).

Communication in the first hours after the crisis includes the following items:

- presenting a brief, concise and focused message to the public about what has happened,
- not go into too much details - providing only relevant information about the crisis / not explaining what the organization, the participants, etc. are,
- actions should be expressed in positive terms, not negative - examples: positive „*keep calm*”, negative “*don't panic*”,
- repetition of the message: the correct information is accurate, no matter how many times it is repeated (advertisement); repetition leads to greater trust and resilience in relationships,
- main actions should be transmitted with no more than three keywords, if possible to use rhyming,
- use of personal pronouns „*we promise ...*” *we understand the needs of ...*”

What to avoid when informing people:

- technical jargon and euphemisms - create a sense of uncertainty and lack of honesty,
- condescending and condemning phrases: „*you must be an idiot to try to escape the epidemic*”,
- attack: *attack the problem, not people or organizations*,
- promises / guarantees - only what can be secured,
- the magnitude of the problem can be discussed in the initial phase of the crisis, in the context of the health and safety of people and society. Loss of property is second, third is what the financial cost is,
- humor - sometimes helps reduce stress, but in most cases does not work. For some people, humor works well, and others causes a stroke.

## 2. COGNITIVE SYSTEMS IN 2020

Current trends are expressed not only in building resilience in crisis, but also in the massive use of advances in cognitive technologies. The benefits of cognitive technology are well described in the professional literature, and such models are one-step ahead of conventional artificial intelligence systems.

David Kaney<sup>10</sup> is the general manager of the IBM Watson project, suggesting that AI can be smart as far as people teach them. Cognitive computers use a combination of artificial intelligence, neural networks, machine learning, natural language command execution, mood analysis and context sensitivity, their purpose to solve everyday problems in a human-like manner.

<sup>10</sup> Toward Data Science. How are Enterprises benefitting from Cognitive Technology? <https://bit.ly/2w9ufhL>

EBM views cognitive computers as advanced systems that are trained so that they can interact with humans in a natural way. This type of computer is a different concept from the one based on the development of artificial intelligence.

Unlike AI, which only cares for a specific problem, cognitive systems learn by examining patterns of behavior and offering people relevant actions based on their own understanding of the situation. In the case of artificial intelligence, the system assumes complete control of the processes and takes action to complete the task or to avoid one or the other of the scenarios using pre-introduced algorithms. With cognitive technologies doing the opposite, they only act as human assistants, rather than performing the task themselves. They provide people with more opportunities for a more complete and accurate analysis of the data without worrying, for example, about the wrong decisions made during machine learning processes.

Cognitive computing system<sup>11</sup> have the primary purpose of assisting human decision-making, as well as improving its precision and quality, enabling people to get to grips with the essence of important, critical processes. A cognitive computer system has three key elements:

- a – natural language for request processing and process analysis,
- b – algorithms integrated into machine learning and
- c – real-time computing processes.

Cognitive computing will completely change the field of digital technology, according of Gartner<sup>12</sup> institute and lead to the emergence of a new type of technology solution in the next few years.

Benefits of introducing such technology:

- accurate data analysis; high efficiency in selecting, classifying, and searching for hidden links in the analysis of information,
- analysis of emerging business trends and effective process management,
- limit the risk in changing circumstances and environment,
- improving human interaction: automating processes, providing relevant, contextual and valuable information,
- improving the human experience, better customer satisfaction in engaging with business.

Problems:

1. Security: the ability to process huge amounts of data, analyze situations and processes is a challenge to ensure data security and encryption.
2. Business acceptance and approval: requires long-term vision, attitude to adopt the new model for management.
3. Change management: people by definition resist any new change. However, the technology itself will lead to greater synchronization between people in the business process.

Instead of trying to build a limited form of artificially intelligent enterprises, they try to take advantage of cognitive technologies to automate processes to solve a wide range of problems that require some element of knowledge. The main aspects of knowledge are related to the so-called

<sup>11</sup> What is Cognitive Computing? How are Enterprises benefitting from Cognitive Technology?  
<https://towardsdatascience.com/what-is-cognitive-computing-how-are-enterprises-benefitting-from-cognitive-technology-6441d0c9067b>

<sup>12</sup> Top 10 strategic technology trends for 2020  
<https://interestingengineering.com/top-10-strategic-technology-trends-for-2020>

„P” categories of perception / awareness / understanding of our environment as inputs to such systems come from sensors. The model is relevant to cognitive technologies, which include, in this case, both image and object recognition and classification (facial recognition), use of natural language, generation of unstructured texts, information processing, sensors implanted in robotic objects, reading signals coming along the line of IoT and other forms of perceptual calculations.

A new area of research is to focus attention on the ability to perceive the environment, develop advanced forms of neural networks, and in particular develop deep learning. Prediction is the introduction of models by which one can determine what is to come and learn from different types of interaction. Forecasting focuses on the use of cognitive technologies based on machine learning, enhanced learning, big data, statistical approaches to processing large amounts of information, identifying anomalies, and suggesting next steps for action. In addition, forecasting focuses on a wide range of cognitive technologies, including analytical models of Big Data analysis and the use of human decision-making methods. The cognitive technologies used in planning are oriented towards the development of AI in order to improve the performance of machines in terms of intuition, sensitivity, emotions and other factors that enhance the planning and decision-making tasks.

## 2.1. The future of cognitive technologies

Expert Max Tegmark<sup>13</sup> shares that artificial intelligence is integrated into artificial intelligence, which is not purely biological. We do not yet fully understand what biological intelligence is and trying to build an artificial one is a challenge. On a more abstract level, AI is a machine behavior and similar functions that mimic human intelligence and behavior. On the other hand, this type of technology refers to processes related to learning, problem solving, understanding and interaction with the real environment, as well as conducting conversations and linguistic communication. The ultimate goal is to build a common artificial intelligence that is able to solve any problem, understand situations and execute processes specific to man.

Creating Artificial General Intelligence (AGI) is the endeavor of most academic institutes and laboratories. In practice, many experts who talk about market-oriented AI do not consider AGI, nor the answer to the basic question about intelligence inherent in biological units. The current understanding of AI is too limited - such technologies are oriented towards solving specific, business problems.

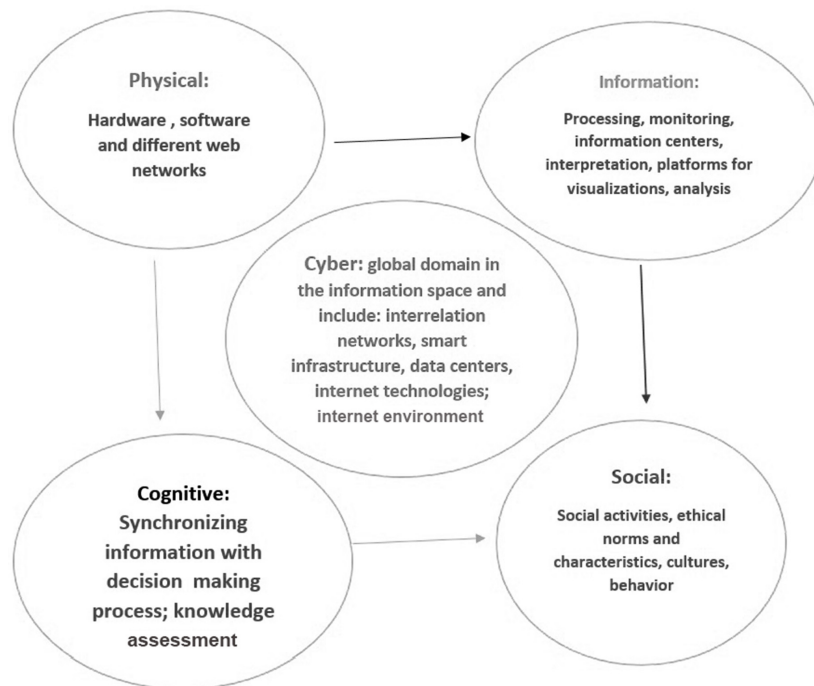
In 2020. New trends in technology are emerging, such as hyper-automation and autonomous objects, which present challenges for information security and crisis teams. This suggests that crisis and risk leaders need to focus their attention in three key areas: systems protection, with AI built in; use of AI to enhance prevention capabilities; forming attitudes that attackers will make greater use of AI models to break through infosystems. In addition to the trends outlined above, it is expected that new trends will be developed related to the design of post-digital architecture, built on different logic, compared to traditional computer systems. This implies the creation of new programming languages and algorithmic strategies. The focus is now on atoms, not bits. Quantum and neuro-morphic calculations will accelerate these trends, but in a different

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<sup>13</sup> Source: Why Cognitive Technology May Be A Better Term Than Artificial Intelligence  
<https://www.forbes.com/sites/cognitiveworld/2019/12/22/why-cognitive-technology-may-be-a-better-term-than-artificial-intelligence/#5465469a197c>



direction. We are currently witnessing a new era in innovation driven by non-standard, computer architectures, genetics, materials sciences, and artificial intelligence. This necessitates a transformation of the organizational structure, orienting itself from vertical hierarchies to horizontal networks. Such trends will also impact cyber crisis management models towards more effective analysis of trends, threats, identification of cyber system breaches, and rapid response to their automatic remediation.



**Figure 1.** Cyber space – basic domains

## 2.2. New cognitive technologies<sup>14</sup> in risk and emergency situations.

Instead of trying to build a limited form of artificial intelligence-innovative businesses are trying to take advantage of cognitive technologies in order to automate the processes of solving wide range of problems that require some elements of knowledge. The main aspects of knowledge are related to the so-called „P” categories; (Perceive, Perception, Predict); Perceive - understanding our environment as the input signals for such systems come from sensors; Perception - related cognitive technologies include image and object recognition and classification (including facial recognition), natural language processing and generation, unstructured text and information processing, robotic sensor and IoT signal processing. Prediction-focused cognitive technologies utilize a range of machine learning, reinforcement learning, big data, and statistical approaches to process large volumes of information, identify patterns or anomalies, and suggest next steps and outcomes.

A new area of study is focusing attention on abilities for the perception of the environment, the development of advanced forms of neural networks, and in particular the development of deep learning. Forecasting focuses on the use of cognitive technologies based on machine learning, enhanced learning, big data, statistical approaches for processing large volumes of information, identifying anomalies, and suggesting next steps for actions. Prediction focuses on cognitive broad-spectrum

<sup>14</sup> See. Why Cognitive Technology May Be A Better Term Than Artificial Intelligence.  
<https://www.forbes.com/sites/cognitiveworld/2019/12/22/why-cognitive-technology-may-be-a-better-term-than-artificial-intelligence/#29bc7b9d197c>

technologies, including analytical models, Big Data analysis, and the use of decision-making methods typical of humans. In recent years, cognitive approaches have been actively applied, mainly related to the development of cognitive capabilities for cyber security and financial management decisions. The cognitive technologies used in planning are oriented towards the development of AI in order to improve the performance of machines in terms of intuition, sensitivity, emotions and other factors that enhance the planning and decision-making tasks especially in emergency situation.

Research shows the following major trends:

- the first security challenge today and in the future is related to limiting response time and solving incident problems and
- cognitive decisions are expected to increase significantly in the next 2-3 years.

The company Intel<sup>15</sup> in 2020 declares the future of technologies by defining them as heterogeneous computational calculations, in this case combining traditional digital chips with non-digital architecture, such as quantum and neuro-morphic systems. In such systems, data processing speeds are 1,000 times faster and 10,000 times more efficient than traditional chip capabilities. IBM is creating a network of advanced quantum technology, bringing together research labs, startups and accelerating companies to innovate. The work of post-digital architecture is built on a different logic, unlike traditional computers. The focus is now on atoms, not bits. Digital technology has revolutionized areas such as genetic engineering and materials science. Artificial intelligence and cloud systems have changed industries such as manufacturing and agricultural technology. Quantum and neuro-morphic calculations will accelerate these trends, but in a different direction.

We are currently witnessing a new era in innovation, powered by new computer architectures, genetics, materials sciences, and artificial intelligence. This forces a transformation of the design of organizations, moving from vertical hierarchies to horizontal networks, it is especially important for crisis management process. Over the next decade, new computer architectures will move toward synthetic biology and materials science that will redefine areas such as healthcare, energy, and manufacturing.

Today we have new development in the field of machine learning (ML) and our proposal is to integrate such platforms in the systems of crisis and risk management. ML is a method by which algorithms adapt their activity depending on the data entered into the system, rather than being pre-programmed to perform certain tasks. Researchers working in this direction in 2020 are taking new approaches and in particular are developing AutoML, and the machine learning process is progressively automated, relying more on computer time than engaging people for training, with great loss of time.

Google scientists<sup>16</sup> have published an article on the arXiv server describing the essence of this new concept. The program they use is called AutoML-Zero. It can generate 100 unique algorithms, then orient themselves to solve simple tasks such as pattern recognition. When comparing this method with the approaches for manual training of machines, the results are better, as a code that does not meet the set parameters is removed from the system. In the future, analysts hope to create

<sup>15</sup> The Digital Revolution Is Ending. Here's What You Need To Do Now. Satell, Greg.  
<https://medium.com/@digitaltonto/the-digital-revolution-is-ending-heres-what-you-need-to-do-now-774608a87804>

<sup>16</sup> Google scientists develop software that could enable AI to evolve with no human Input  
<https://www.iflscience.com/technology/google-scientists-develop-software-that-could-enable-ai-to-evolve-with-no-human-input/>

more sophisticated and complex AI systems. Their goal is to demonstrate how automated methods are used to discover new algorithms as part of the ML process; the model is combined with basic mathematical operations such as basic building blocks for improving the learning process.

### 3. CONCLUSION

The challenge for today's crisis and risk managers is to build flexible, intelligent infrastructures geared to new cognitive technologies and neuro-morphic systems in order to respond quickly to crises occurring in the public, cyberspace, and the information domain. Crisis and emergency response times are calculated in minutes, for example in global viral epidemics, within hours. In critical situations in the absence of knowledge and competencies, and if the leaders do not act within the specified timeframe, any further decisions will prove inadequate.

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