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### **Discussion paper: AI and changes in hierarchical organizations V0.9.**

In late 2019, I was asked to contribute to the AFCEA Workshop in Brussels (February 2020). My contribution primarily deals with providing insights into the changing field of Command and Control (C2) caused by new technology; more specifically, Artificial Intelligence (AI). In this article I'll share my perspective on developments in C2 in both the near and intermediate terms (i.e. 1-7 years from now), and I will largely avoid using specific terms related to military C2 and will instead utilize more generic jargon related to developments in big, hierarchic organizations in the West.

First, I will point out the major technical and AI related developments that I researched together with The Hague Centre for Strategic Studies (HCSS) in 2018 combined with results of our studies of the future of the Command Post by the NATO C2 Centre of Excellence (COE). From these predicted developments I will then sketch the most probable major developments in the organizational structure, business processes, and culture.

The goal of this written mental exercise is to establish a framework for discussions about the underlying mechanisms for the workshop while not making overt predictions on the future. With that in mind, this discussion should serve as an educated opinion more than an academic-proof.

#### *Developments*

AI is evolving and adapting, and we as a society are moving up in the 5 levels of automation established by Endsley and Kaber in 1987. The expectation is that it will be possible to reach level 5 (full automation, no operator required,) but that societal/market acceptance will stagnate at level 3 (consensual AI; the operator has to consent) or 4 (monitored AI). The emergence of discussions like "the man in the loop" approach with a sort of maximum for decision making as seen in "the man on the loop" further underline this expectation.

An ever changing workforce and fiscal constraints in the western world for governmental organizations is becoming a constant, so developments that reduce the number of personnel needed and keep up, or enhance the service levels are necessary.

AI is dependent on sensors, connectivity, data, and computational power. The pace of developments in these technical areas match the development of AI algorithms, so growth in this area should not be seen as a potential limiting factor.

The speed and complexity of changes in our environment continue to increase; some even believe exponentially. This change can't be processed by the human brain alone. Systems to assist, or even replace, the human brain are essential for surviving in our ecosystem. AI can and will help us to take the necessary actions to counter near future challenges.

## *Organizational Structure*

The word hierarchy appeared for the first time in the late 1800s in the UK, but the Greek origin “Hierarkhia” shows that the structural principals are much older. There are two design principles for hierarchies that are heavily influenced by current technological developments as AI’s role in information management and the maximum span of control.

A hierarchy’s functional lines are used to get information upwards, to a level where it is processed and interpreted. The results go downwards via the same organizational lines in the form of tasks or targets. The increased availability of information, tools to process information, and more indirect management models diminishes the role of the hierarchy for information management. Every level can get its own information from a *data lake* or *cloud* and process it into actionable information. Artificial Intelligence will improve this process even further, so answers will appear to unknown questions in the form of suggestions. This in turn will reduce the number of personnel dedicated to information management.

In the first half of the last century, an optimal span of control was defined as a one-to-four ratio, or less; so one directing element could guide a maximum of four subsections. This was based on the minimum personal contact necessary for effective communication, mental capacity, and information span. From the 1980s onward, this changed in the commercial world by the introduction of information technology (IT). However, many governmental organizations in the western world kept using a variant of a hierarchical structure with a narrow span of control that created numerous organizational layers.

From the onset IT was a trigger for changes in the organizational structure of commercial hierarchies. Further developments in IT, and especially AI, in tandem with increased speed and complexity of our society will enforce other hierarchies to adapt, flatten, reduce size, and become partly unmanned.

## *Business Processes*

As stated, developing technology will inflict a loss of vertical flow of information through the hierarchy. This means that the old processes will be replaced by routines that create the horizontal information flow on every level with a *cloud* or *data lake*.

This combines seamlessly with the principle of putting decisive power as low as possible in the organization (so decentralized instead of centralized). Aside from the decisive power in the primary processes, the same independency can be created for all supporting functions, but this distribution of (decisive) power comes with an intensified need for risk management on the central level. The provisions for risk management will increase, as will the available technology, and data to support. The emphasis for the decision maker will be in defining the proper questions and the critical information requirements for his/hers risk management.

As AI matures, the processes will be evaluated and adapted automatically by self-learning algorithms. This means that people will be confronted with a front end user interface, not knowing the process precisely. In one of the studies of the NATO C2COE we discovered that older and younger generations are willing to accept new technology, based on necessity, but the trust in the system will hold as long as the system performance meets the expectations. This puts a heavy emphasis on robustness of processes and systems, and a priority on guarding this trust at the higher level.

## *Culture*

In an organization that is accustomed to human interaction, it's hard to adapt to a situation with less humans and more technology. The question is, if there even will be a clear corporate culture as a guideline for behavior? Will human interaction naturally build up a conducive corporate culture? Integrity and ethics are intertwined with culture, thus this is a topic that should be discussed before organizations adapt to new technologies; culture should be part of the design. That leads to the question how leadership looks like if there are not interacting humans to lead? The leadership of tomorrow could be the risk managing, last resort for the *human in the loop* decisions type.

This requires AI to handle serious human characteristics. The value of non-verbal communication should be captured, as well as the buildup of tacit and explicit knowledge. These aspects of rich human interaction have a direct connection to productivity and should either be simulated, or replaced by better (faster, richer) routines that keep the organization in sync with its environment.

The introduction of systems as assistants to humans won't change the culture and the rich human interaction fed by culture. The introduction of more evolved AI in which the human assist the technology (and vice versa), or where AI runs on full automatic mode, (like your virus scanner does) AI has to address the objective factors, as well as the subjective human factors. Because in the end, a human will make a decision even without information, based on his ethics and gut feeling, and for now AI can't...

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*Leader with a natural focus on people, robustness and simplicity. Motto: Do! 30+ years of experience in national and international work for the Dutch MoD. Always striving for matching routines to a changing environment and reaching that goal with the team. Knowledge and experience in the field of: Leadership, Simulation, Innovation, Cyber, Operations, Education, Teamwork, Training, Decision making and Management.*