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## ► To cite this version:

Gilles Desclaux, Bernard Claverie, Laurent Chaudron. Cognitive computing and augmented intelligence in man-system integration: Impact on C2 HQ key processes. 3rd NATO Command and control User's Conference : Emerging and Future C2 Technology, NATO NCIA, Jan 2017, The Hague, Netherlands. hal-01672745

**HAL Id: hal-01672745**

**<https://hal.science/hal-01672745>**

Submitted on 27 Dec 2017

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**« Emerging and Future C2 Technology »**  
**3rd NATO Command and control User's Conference**  
1/1/2017 to 2/2/2017 - Organizer: NCI Agency - Location: The Hague

Cognitive computing and augmented intelligence in man-system integration:  
Impact on C2 HQ key processes

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**Teaser**

For who has exercised high-level responsibilities in an operational headquarters, to imagine having at his disposal a relevant Assessment process, an effective Wargaming machine for his planning teams and a system running a perfect Critical Information process to support his main decisions should be sense as a dream. That could have changed his life and more importantly the outcome of his operations!

Technology is there and that's what our Research and Study Team is all about. We combine Academia, Basic and Applied Research and the Military Institution.

The core idea starts with our vision of C2 as a Cognitive engine with a strong Human/Systems teaming in support of a strategy. From there, we believe that any future evolution of C2 will have to be processed through 3 methodologies which are UX, for User eXperience, well known today, KX, for Knowledge eXchange, at the heart of what the new cognitive tools will bring, and HX, for Hybridity eXtension, which leads to Human Augmentation.

We are at the beginning of our research project. What we intent presenting is the way we have designed it, and the path leading to a possible future for C2.

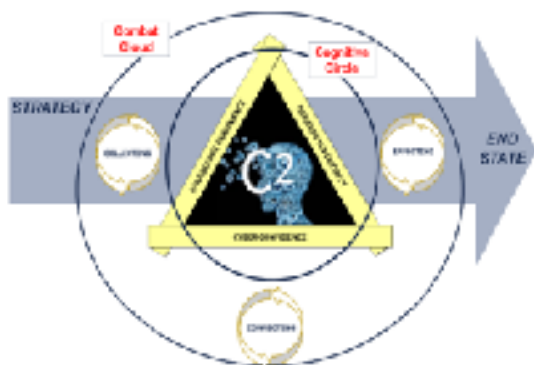
**Abstract from research project presentation**

The history of human thought augmentation is confused with that of calculation, of numbers, and of their use. The epic of automatic calculation thus structured history and politics, religions and myths, but also allowed the advent of science and the development of technologies. Today we are facing a breakthrough in tools and methods, but also in the field of assisted thinking, promoting new capabilities and new perspectives for understanding and mastering the organization of the world. Recent developments in intensive computing, parallelism and artificial intelligence allow considering a real technological assistance in the management of sociotechnical crises, and especially in the management of new type of conflicts. C2 is precisely at the heart of this evolution.

**A C2 vision**

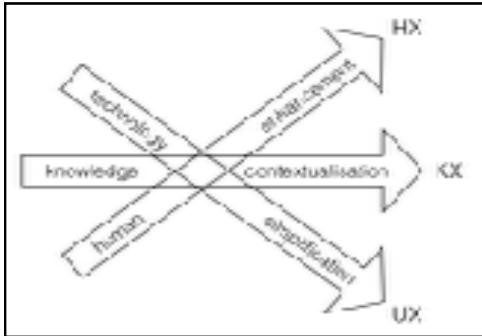
Deeply impregnated with technology, C2 is designed to plan, direct and control groups of people and means made available to commanders to carry out military objectives.

C2 corresponds to the implementation of a theoretical "machine" in support of a strategy, relying on data collecting and processing devices, communication and information systems, in order to implement decisions and generate effects. This machine includes a set of processes, methods and knowledge management techniques known as the C2 "cognitive circle".



## Various methodologies for Human ability augmentation

Cognitive computing was interested in the complementarity of human and machine, whereas Cognitics science was interested in the integration of human and systems (IHS) conceiving the duo as a single set capable of solving global problems where an isolated man or the system are less efficient than a man enhanced by technologies.



Three methods of augmentation are examined in this disciplinary conjunction:

First of all refinement of interfaces, user's experience (comfort, performance, safety, control of the error ...) and what AI bring to fluidity in relations and human-system articulation (UX for User eXperience).

Second is information processing enhancement: making knowledge directly and smoothly accessible to all users, from Commanders to operators, up to political masters. This refers to AI applied to knowledge management and knowledge sharing (KX for Knowledge eXchange).

Finally, how AI increase the performance of humans collaborating with systems which opens the way towards hybridity (HX for Hybridity eXpension).

## Technologies involved

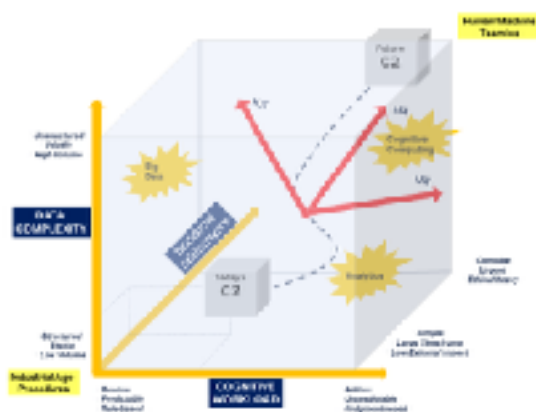
Cognitive computing and advanced analytics are game changers. The technology is there now. What are the technologies allowing these evolutions and what role does AI play in their implementation?

The "analytics" allow taking advantage of this massive processing capacity to understand them in order to predict. It is a step higher than the big data processing, enjoining them a power of anticipation which is all the more difficult as it concerns longer time constants.

"Cognitive computing" is an additional step in the "intelligent" exploitation of data in order to create learning systems of filtering which help the user in his reflections and analyze data within the complexity of available knowledge. AI aims to suggest rather than impose coherent, credible, secure and operational options. Here we are more in the field of assisted intelligence where the duality human-system is at the center of a performance guided by a defined strategy and directed towards a goal to be achieved.

Despite steep progress, AI will remain work best when paired with humans.

## Our Project



Our project is to transform C2 from industrial age procedures to Human/Machine Teaming. It defines a path leading to a future C2. It is based on the dual choice we make to focus on strategy-to-task and to enhance it with cognitive tools, allowing for a better understanding of crises' dynamics.

The only way to deal with complexity is to build on a methodology that, thanks to a symbiotic Human and Machine cognition, will leverage a shared consciousness of crisis dynamics and thus enhance quality and speed of decisions, in order to better master the desired effects.

## Impact on C2 decision making and HQ processes

How will these technologies influence the main processes driving the decision cycle in a C2 organization?



The basis of all military action lies in the planning process. It is synthesized by the "Operational Design" of which it is useful to share a clear representation. This Commander's tool, continuously revised and improved, is the backbone on which are organized all the C2 key processes. These processes allow a Commander to develop situation Awareness, disseminate his intent and manage risks.

In the context of today's complex, lengthy operations where people are the stake, the volume, the structure and the volatility of information entail highly intensive and particularly difficult processes to make sense of it. That's what Cognitive computing and Analytics will greatly facilitate.

In fusing in near real time ISR products, internet open data and social networks information, structured and unstructured data, C2 operators will benefit from more accurate indicators and warnings (CCIRs), improve planning (Wargaming) and get a better insight of the effects they are creating : physical, psychological and perception effects (Assessment). Finally this will greatly enhance the risks management process, balance between risks to the force and risks to the mission, the Commander's most critical challenge.

The enhancement of Wargaming, Assessment, and CCIR processes through cognitive tools will represent the first stage of our research project.

## Impact on C2 HQ – Sensitivity to Info Ops

The implementation of these renovated key processes will largely impact the decision-making cycle, the HQs organization, manning and quality/training requirements for the personnel arming the C2 structures. This research project will then provide a first insight on these evolutions and their impact on efficiency, quality and speed of decisions, and C2 battle rhythm.

We can expect having created a robust improvement in situation awareness and crisis dynamics understanding thanks to an integrated human and machine cognition. This should enhance integration of C2 HQ functions, and allow C2 approach space to evolve towards a more distributed C2.

We will subsequently assess the impact of these planning cognitive enhancements on the control of real time operations. Finally, we will deeply examine the sensitivity of these enhanced processes to Information warfare.