

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

LTG (Ret) Gilles DESCLAUX (Senior Operational Advisor TRS - Massy France) &
Prof. Bernard CLAVERIE (Director ENSC - Bordeaux France)

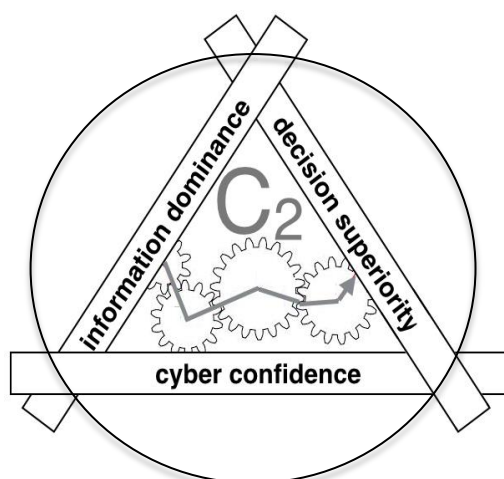
(With collaboration of Hervé LE GUYADER - STO correspondent for ENSC - ENSC Bordeaux France)

Abstract from academic 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. The latter structure the whole range of human activities, particularly regarding "sovereignty 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 to consider 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, but also with strategy and human decision making, C2 is designed to plan, anticipate 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 communication and information systems, data processing devices, in order to implement decisions. This machine include a set of processes, methods and knowledge management techniques known as the C2 "cognitive circle".

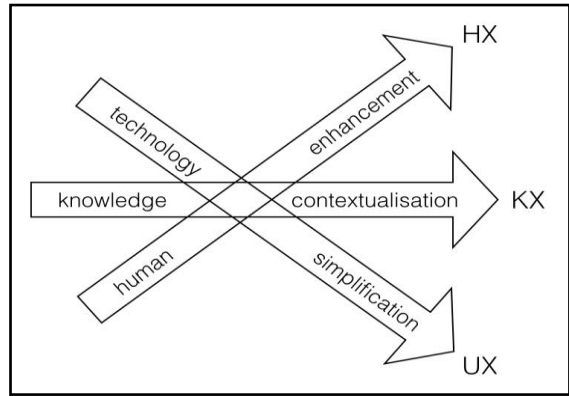


At the end of the last century, cognitive computing was interested in the complementarity of human and machine, whereas Applied Cognitive Science (Cognitics) was interested in the integration of human and systems (IHS) conceiving the anthro-technical duo as a single set capable of solving global problems where an isolated man or the system are less efficient than a man enhanced by technologies.

Various methodologies for Human ability augmentation

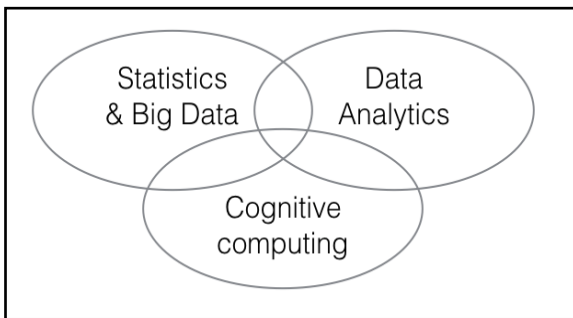
Three methods of augmentation are examined in this disciplinary conjunction:

- First of all refinement of interfaces, user's experience (comfort, performance, safety, error control...) 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 the user, as well as to the partners and the commander. This refers to AI applied to knowledge management and knowledge sharing (KX for Knowledge eXchange).
- Finally, how AI increases the performance of humans collaborating with systems which opens the way towards hybridity (HX for Hybridity eXpension).



Involved technologies

What are the technologies allowing these evolutions and what role does AI play in their implementation?

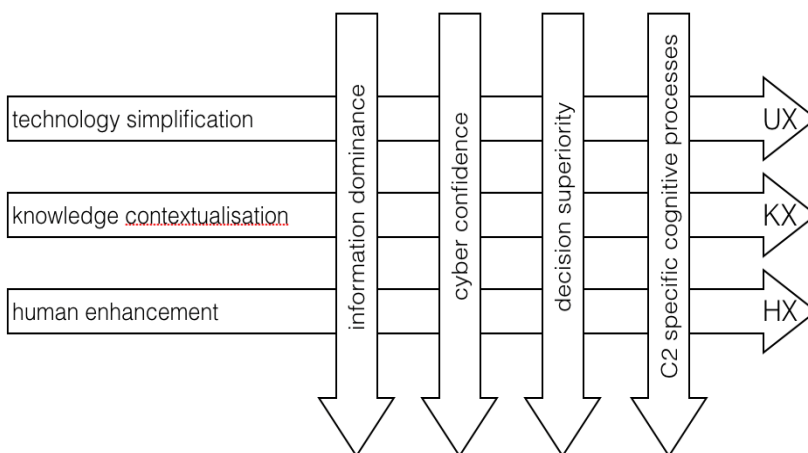


Data, whether in fixed forms of statistical tables or in the uncertain cloud of big data, requires an ever-increasing amount of information processing assistance. This volume is constrained by three restrictive dimensions: automatic processing technology, visualization of the expected results, definition of these expectations according to the interest, relevance and utility for the user.

The "analytics" allow to take advantage of this massive processing capacity to understand them in order to predict. It is a step higher than 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 to the "intelligent" exploitation of data in order to create learning systems of filtering capable of helping 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.

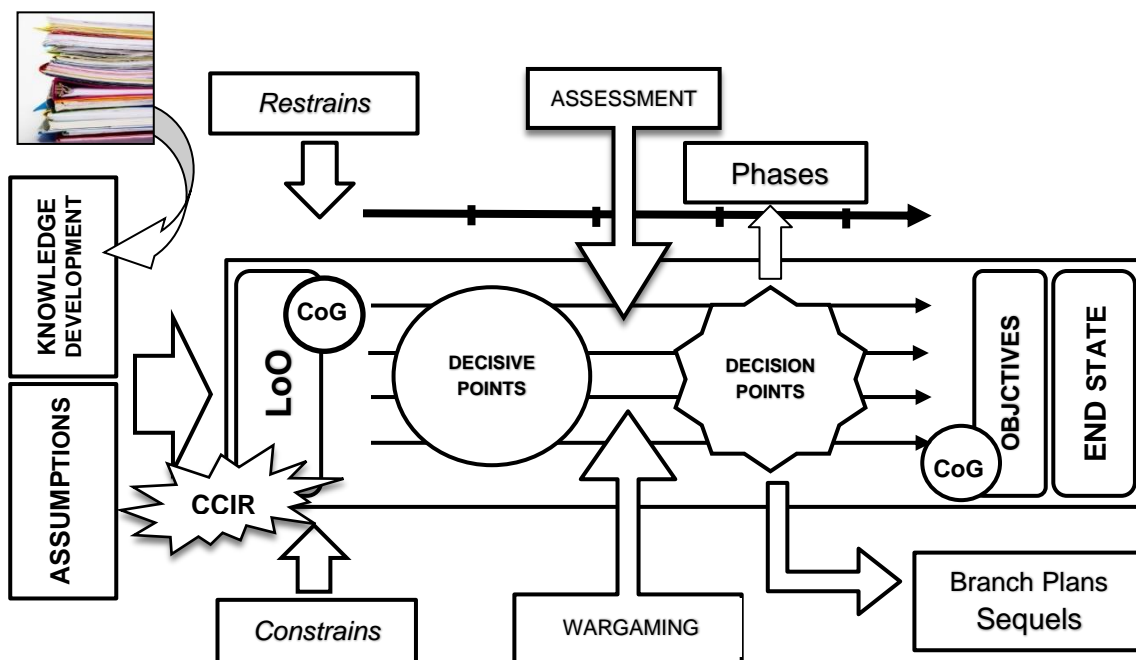


Each of the four C2 domains is instrumentally traversed by the three operational dimensions UX, KX and HX.

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", calling for the need to share a clear representation.



This Commander's tool is continuously revised and improved. It is the backbone on which all C2 key processes are organized. These processes allow a Commander to develop situation Awareness, disseminate intent and manage risks.

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

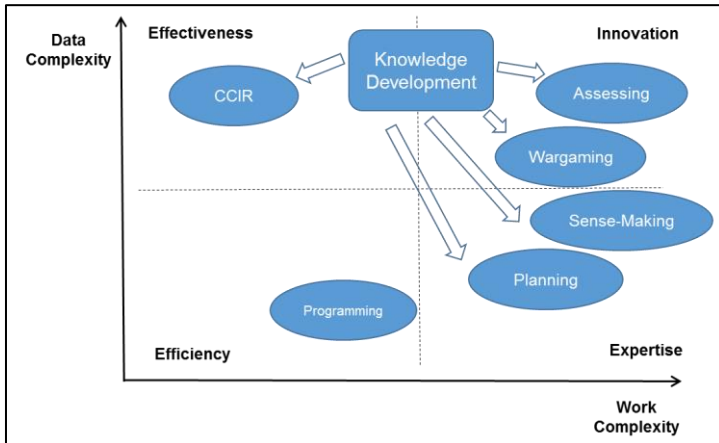
In fusing in near real time ISR products, open data and social networks information, structured and unstructured data, C2 operators will benefit from more accurate indicators and warnings, improve the targeting process and get a better insight of the effects they are creating: physical, psychological and perception effects. 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.

Focus on key processes

At this stage, the presentation will focus on three key processes depicted in the scheme¹ below in relation with their respective complexity of work activities as well as the complexity of data used for those activities.

Four activity models which depict different types of Cognitive Computing solutions are identified. We will address two of them:

¹ Inspired from ACCENTURE: "Turning Cognitive Computing into Business Value", 2016.



- Innovation model: Cognitive Computing augment understanding of conflict dynamics and creativity in helping identify solutions,
- Effectiveness model: technology helps human in monitoring activities, handling of routine questions and formulating hypotheses.

Typically Wargaming, Assessment, Commander's Critical Information Requirements are the best kind of collaboration between humans and machine we will get, and we will examine them.

Impact on HQ manning, battle rhythm and organization

The implementation of these technologies in support of key processes will largely impact the HQs organization, manning and quality/training requirements for the personnel arming these C2 structures. The presentation will provide a first insight on these evolutions and their impact on efficiency, quality and speed of decisions, and C2 battle rhythm.

We can expect that the improvement in Situation Awareness and Knowledge sharing will enhance integration of C2 HQ functions, and allow C2 approach space to evolve towards a more distributed C2.

Cognitive Computing and advanced analytics: the missing link for EBAO implementation?

The presentation will conclude addressing the old issue of EBAO implementation. After various experimentations and exercises, EBAO was progressively introduced in NATO, considering it was an interesting philosophy which reflected a way of thinking that complements the manoeuvrist approach. A few years later, it was considered that the concept had not matured enough, was too mechanistic and was demanding the involvement of very large staff to assess effects. In the end, the tendency was to inhibit information flow and to hinder rapid decision-making.

New technologies are likely to change this. The automation of the Assessment process, the expected quality of Wargaming and the ability to develop a relevant and comprehensive knowledge base could lead to a revival of this philosophy.

Alberts D.S., Hayes R.E. (2006), « *Understanding Command and Control* ». Washington (DC, USA) : US Department of Defense CCRP Publication Series.

Claverie, B., Desclaux, G. (2015). « *Commande, contrôle, communication : gestion cybernétique de systèmes d'information* ». Hermes, CNRS, 71, 70-78.

Claverie B., Desclaux G. (2016) « *C2 - command and control : un système de systèmes pour accompagner la complexité* ». Communication & Organisation, 50 (on press).

Collectif (2015), C4ISR&Networks. « *Managing massive data* » (white paper). Washington (DC - USA) : Air Force Cyber Initiatives, 2015

Hutchins, E. (1995), « *Cognition in the Wild* ». Boston (USA, Massachusetts) : MIT Press.