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Cognitive Warfare: The Future of Cognitive Dominance

First NATO scientific meeting on Cognitive Warfare (France) – 21 June 2021.
Symposium organized by the Innovation Hub of NATO-ACT and ENSC,
with the support of the French Armed Forces Deputy Chief of Defence,
the NATO Science and Technology Organization / Collaboration
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Scientific Editors

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Chapter 9 – CYBERPSYCHOLOGY¹

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Cyberpsychology can be defined as the study of mental phenomena related to cyber-systems and their context. The term “cyberpsychology”⁴ is a neologism which refers to two interwoven concepts: “psychology,” the study of behavior and thought, and “cybernetics,” the science of the laws of control and communication for mechanisms and machines operations.

9.1 MACHINES AND HUMANS

While it is common to speak of the confrontation between AI and Natural Intelligence (NI), or of transcending NI with an AI that can be misunderstood as something frightening, which might cause disturbances or even threaten our individual and collective liberties, many scientists have been developing a reflection under the term “cyberpsychology.” The advent of intelligent machines is for some a solution to cope with human problems; for others, it stands as a threat to the future of humanity. Undoubtedly, the cybernetic world keeps transforming humans and it will probably transform them even more in the future.

Intelligent robots are used in factories, hospitals, railway stations and airports. They will soon appear on battlefields. Cyber collaborators invade our homes, offices and living spaces. This is not without consequences for society, for social groups, but also for individuals, as they transform their bodies and their minds. How do humans adapt to this global change, and how does the cybernetic world adapt to humans who change? These questions lead scientists to take an interest in these joint evolutions, in their mutual effects on thought, intelligence, emotions, personalities, and on the modes of machines design, their use and their transformation. Thus, it is necessary to investigate the relation between humans and cybernetic systems, artificial intelligence, robots, etc.

The evolution of AI involves new words, new concepts, but also new theories that encompass a study of the natural functioning of humans and of the machines they have built and which, today, are fully integrated in their natural environment (anthropotechnical). Tomorrow’s human beings will have to invent a psychology of their relation to machines, but the challenge is to develop also a psychology of machines, artificial intelligent software or hybrid robots.

In this context, cyberpsychology is at the crossroads of two main fields: psychology and cybernetics. It is understood as the science of the mechanisms of behavior and thought in humans, and of the psychological laws that apply to the cybernetic space and to cybernetic systems. As an autonomous discipline correlated to its mother disciplines, it has been developing since the end of the 20th century, and it shares their characteristics, their limits and their methods while encompassing other traits which result from their reciprocal relations. Centered on the clarification of the mechanisms of thought and on the conceptions, uses and limits of cybernetic systems, cyberpsychology is a key issue in the vast field of Cognitive Sciences.

¹ This text was originally published on the NATO-ACT Innovation Hub website (Norfolk, Virginia, USA) on 1 June 2018. It was provided to the participants of the first “Cognitive Warfare” day as a basis for discussion.

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⁴ Cyberpsychology and Cyber-Psychology are synonyms. The same goes for Cybercognitics and Cyber-Cognitics, Psycho-Cybernetics and Psycho-Cybernetics, Cybersystems and Cyber-Systems, Cyberdependance and Cyber-Dependance, Cybertechnology and Cyber-Technology, etc.

9.2 CYBERPSYCHOLOGY AND THE “CAUSALITY PROBLEM”

The relationship between mind (psycho) and cyber (Information technology) should be investigated from different angles. While the scientific field is sometimes inappropriately reduced to a one-sided definition of cyberpsychology, it is crucial not to restrict the field of research to virtual reality or psychotherapy applications. Cyberpsychology raises numerous questions, in particular those regarding the motivations, the needs, the reluctances and the difficulties linked to the use of cyber tools and to their environments. Other issues include the design, the implementation, or the control of cyber-systems with respect to psychological characteristics and processes.

Therefore, cyberpsychology can be connected to different concrete topics, among them health issues, aerospace and transport, global security, military organizations, decision making, education, etc. In fact, in terms of research and application, cyberpsychology includes three distinct categories, and their differences are based on the causality link between the respective elements of each of the psychological and of the cybertechnical worlds, and their variation. These elements are called “variables.”

According to the famous English epistemologist Karl Popper (2002), common sense tends to assert that “every event is caused by an event that precedes it.” This spontaneous conviction is central to the “deterministic perspective,” according to which everything or every fact has a cause. Some scientists go even further and are convinced that each event provokes another event. Thus, everything can be said to have a cause and a consequence. This intellectual position is called “universal determinism.” In science, at least two consequences follow from the above-mentioned theories: one can thus “explain” anything or any event; and one can also “predict” things or events that will flow from the present or the past.

In this deterministic context, a dependent variable is traditionally defined as an element whose variation depends on the variation of another element which remains independent of the form of the causality. We then say that the variations of one cause or produce the variations of another one. We speak then of independent variable (I) and dependent variable (D). The causal link is oriented from I to D ($dI \Rightarrow dD$). Conversely, the variations of D are not causal of those of I ($dD \Rightarrow dI$), except to define co-variant or correlational variables, in a non-causal relation ($dD \Leftrightarrow dI$) or more exactly, for some scientists, a causal relation that is not yet known or discovered.

These three sub-themes could be respectively defined for cyberpsychology as “cyber-cognitics,” “psycho-cybernetics” and “global cyberpsychology.”

9.3 THE CYBERTECHNICAL INFLUENCE

The cyber effect on the psychological dimension of humans constitutes the first part of cyberpsychology. In all the areas of research, the experimental conditions determine a statute of independent variable for the technical data, and a statute of dependent variable for the psychological data. This field is literally “psycho-cybernetics.”

The effects of these cyber technical dimensions on the mind concern the following points (non-exhaustive list):

- Behavior and thought (cognitive facilitations, cognitive impairments, cognitive errors, ergonomics, etc., cognitive impairment, human error, etc.);
- Psychological traits and personality (structuring, alterations, use in soft power or social engineering);
- Professional training and apprenticeship;
- Education (children, adolescents, adults, young experts, knowledge management, etc.);

- Psycho-rehabilitation, psychotherapy (psychiatry, mental health, post-traumatic stress disorder, brain injury, moral injury);
- Prevention (cyberdependence is now officially recognized as a psychological disease by the World Health Organization).

Table 9-1: Factorial Representation of Different Domains of Cyberpsychology Depending on the Status of Technical (Cyber) or Psychological Causality.

	Psycho-Cybernetics	Cyber-Cognitics
Psychological Data	dependent variables (D) non-causal	independent variable (I) causal
Technical Data	independent variable (I) causal	dependent variable (D) non-causal
Correlativity	covariation/correlation/unknown causality/indeterminacy	

9.4 THE PSYCHOTECHNICAL CAUSALITY

The psychological effect on the cyber field defines a cyber-cognitics domain, and it is possible to describe some of the effects of psychology on cybertechnology or on the cyberdomain (non-exhaustive list):

- Computer programming styles, program structure, etc.;
- Imitations (neural networks versus symbolic programming, hybrid modes, different AI, etc.); – modes of implementation (networks, main frames, intensive computing, parallelism, fuzzy logic and cyberquantum, etc.);
- Digital trust (complete or partial autonomy, monitoring, control, delegation, etc.);
- Digital resistance modes (avoidance coping, procrastination, etc.);
- Psychological cyber defence (cybersecurity, especially invasive, defensive, techniques, attritive, etc.) “man is the first flaw in digital systems,” Man-In-the-Middle Attack (MIMA), etc.;
- Cyber-radicalization (cognitive processes, social environments, prison environment, liberties, rights, etc.).
- etc.

9.5 THE INTEGRATED SYSTEMS

The third type of effect can be characterized by non-causal relations, or unknown causal relations, mainly in complex systems. It concerns the domain of Human-System Integration (HSI) (Booher, 2003; Pew and Mavor, 2007) or Human-Automation Teaming (HAT) (Shively et al., 2007; Demira et al., 2017), in an anthropotechnical world (non-exhaustive list):

- Some elements in human machine interface;
- Human machine teaming;
- Human machine symbiosis, human machine hybridity;
- NBIC⁵ (converging technologies for human enhancement);
- etc.

⁵ NBIC: Nanotechnology, Biotechnology, Information technology and Cognitive sciences (Cognitics) (Roco and Bainbridge, 2002).

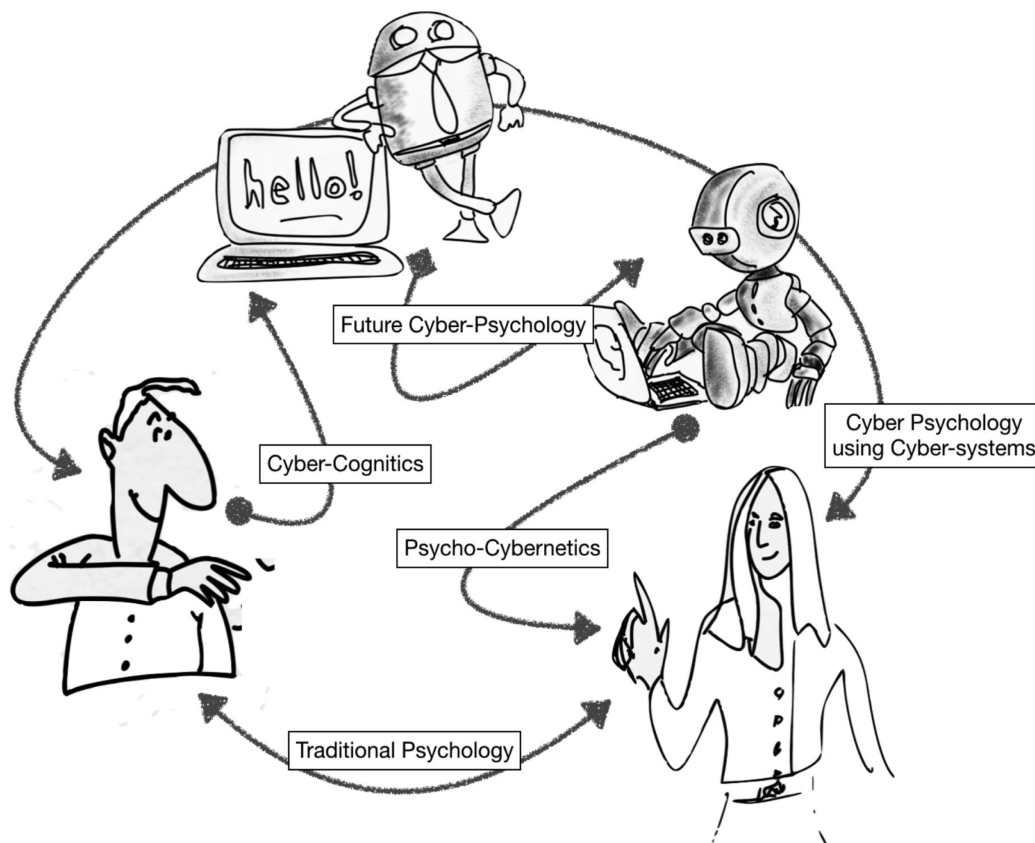


Figure 9-1: The Different Fields of Cyberpsychology in the Psychology Domain.

9.6 CONCLUSION

To conclude, cyberpsychology is a domain of the general psychology, and a developing, complex scientific field which embraces diverse phenomena and different sub-themes involving machines as humans. With the advent of smart and autonomous machines, it has become primordial to develop a new form of psychology, one that will examine the way humans and machines impact on each other. In addition, it will explore how the relation between humans and AI will change human interactions and machines intercommunication.

It calls for accurate definitions and differentiations so as to leave no ambiguity. Research and applications should therefore take into consideration the type and the specificity of the causal relation that underlies the link between psychology and cybernetics. In terms of research and implementations, it concerns a variety of issues related to Defence and Security and to all the areas which NATO prioritizes to prepare its transformation.

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