



What Is Cognition? And How to Make it One of the Ways of the War?

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Cognitive Warfare: The Future of Cognitive Dominance

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Chapter 4 – WHAT IS COGNITION? AND HOW TO MAKE IT ONE OF THE WAYS OF THE WAR

Pr. Bernard Claverie¹

“Metaphorically, during the medical examination, cyber warfare uses the stethoscope and PSYOPS the contents of the pipe; cognitive warfare is concerned with the doctor’s diagnosis.”

“Cognitive warfare” is one of the ways used by specialists to modify, orient and alter human reasoning for the purpose of conquest, superiority or inferiority of individuals, a group of individuals, groups, or populations. It is based on the knowledge of the cognitive processes mobilized by these individuals in the use and the control of their environment, notably technological, by means of digital technologies. Generally speaking, the aim is to modify the awareness that individuals have of reality in order to make them take erroneous decisions or prevent them from taking necessary decisions. “Cognitive warfare” is therefore a practice of using cognition for the purpose of military superiority.

Cognitive warfare is part of the following triad: i) Human and social sciences; ii) Human factors methodology and engineering; iii) Theories of cognition and models of the cognitive processes on which we intend to act. But in order to act or to protect military or civilian actors, operators or decision makers, soldiers or commanders, citizens or elected officials, from deliberate attacks on cognition, it is necessary to understand the phenomenon of world knowledge, of information processing by the brain: cognition.

From the simple acquisition of data from the environment, to the use of the most sophisticated semantic memories, from the control of gestures to decision making in complex situations, all of the “cognitive processes” allow humans to live reasonably in the world. The impairment of cognitive processes has two harmful consequences: i) Contextual maladaptation, resulting in errors, missed gestures or temporary inhibition; and ii) Lasting disorder, which affects the personality and transforms its victim by locking him or her into a form of behavioral strangeness or inability to understand the world.

In the first case, it is a question of causing transitory consequences, circumscribed by a particular critical environment (cf. Figure 4-1). The second concerns the transformation of the decision-making principles of individuals who then become disruptors or responsible for erroneous actions, or even non-action (cf. Figure 4-2).



Figure 4-1: Does the Animal Look to the Right or to the Left, Up or Down, Does it Laugh or Does it Look Bad? Note that it is impossible to see both forms at the same time and that the voluntary passage from one to the other requires a form of “cognitive energy.” The figure is said to be “reversible” and “bistable” (inspired by the figure of the “duck-rabbit” by unknown author and reproduced by Joseph Jastrow, 1900).

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Figure 4-2: A Thinker: What About the Inhibition of Action Due to Indecision or Cognitive Overload?

4.1 DEFINING COGNITION

Cognition is the whole of the means, of the bodily equipment and of the processes that mobilize them, which make it possible to have a knowledge and a representation of the world in which they are inserted and to act on it.

These means are the behaviors or physical activities, and the thoughts or mental activities.

The equipment is what ensures the interface with the environmental information (sensations and actions) or ensures the internal processing of this information. This refers to the nervous system, but also to parts of systems that are associated with it, such as the endocrine system, the muscular system, the system in charge of vegetative regulation or the system of relationships, etc.

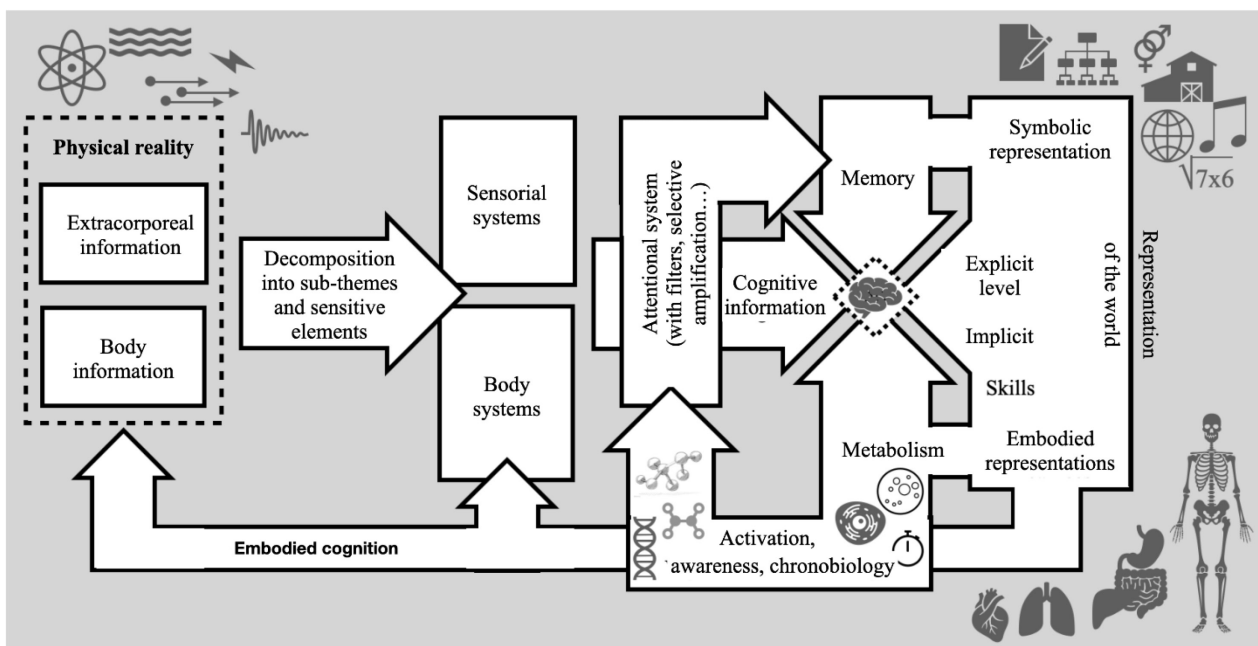


Figure 4-3: Schematic Illustration of the Human Cognitive System Representing Some Major Processes of External and Internal Information Processing.

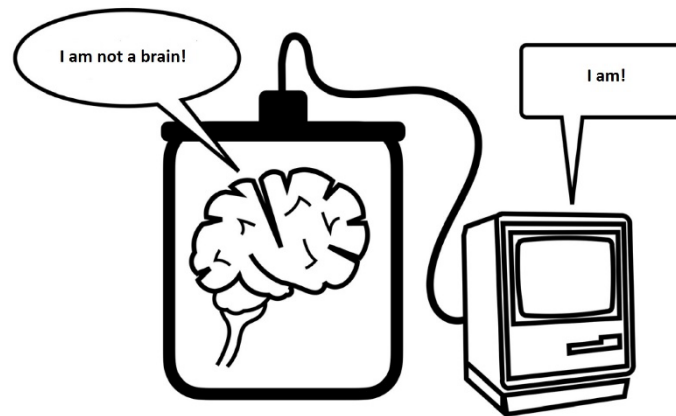


Figure 4-4: Close Relationships Between Brain and Digital World: Causality and Co-Dependence (Claverie, 2021).

The processes refer to the major stages of information processing, from sensation/perception to motor programming and gesture adjustment control, including attention filtering, the various short-term, medium-term, and long-term memory storages, representation, and integration or contractualization capacities, expression, and language, etc. This involves dimensions that are both oriented towards external information and internal information. To simplify, we could say that “cognition is what the brain does with the information in the world.”

4.2 BRAIN AND DIGITAL TECHNOLOGY

The world has little to do with what the brain knows about it. For example, the range of electromagnetic waves that man perceives is extremely limited, between infrared and ultraviolet, and sound frequencies are only known in the strict range of infrasound to ultrasound. The discriminating power of sensory equipment is poor, constrained by limited transfer capacities. Human abilities are fragile, depending on the time of day, on the duration of the stimuli and on nervous fatigue. Attention is a sort of filter protecting the brain from overload. It eliminates the vast majority of inputs, only allowing to pass those that the brain considers useful. Memory, learning, and recognition capacities are mediocre. They are limited to a few perceptual, conceptual, or semantic bases, which reduce the knowledge of the world to what is known and, most often, expected.

From these limits comes the need to get help. This has always been the role of technology. Today, we willingly entrust it with the most boring cognitive operations or those requiring the most energy. This is the case for perception, with devices ranging from simple glasses for vision correction to night vision binoculars or synthetic screens, called “head-up displays,” for car or aircraft pilots. For memory, artificial aids are also numerous. Notes and reminders on cell phones, online consultation of encyclopedias accessible by computer, landing maps or onboard procedures on tablets are other examples.

The downside is that digital assistance produces dependency. The first level concerns the new impossibility of adapting to the complexity of the world without the extension of cognitive capacities, towards an “augmented man” (Claverie, 2010), which today is no longer an everyday fantasy. The second is a consequence. It is the habit and even the desire for permanent and instant access to digitized information, photos, films, press data or scientific analyses, etc. On top of that, there is also the motivation of new users driven by the logic of internet networks and the continuous use of social networks, digital sharing and the “like” culture.

This proximity between cognitive life and the world of digital knowledge has been defined by some authors as a “technium” (Hartley and Jobson, 2021), in relation to globalized and interconnected human knowledge, the so-called “noosphere” (Kelly, 1995). Cognition is no longer just a matter of the brain. It is, at least since the last decade, in a natural relationship with digital technology and shared knowledge. This double relationship is therefore bilateral and dual. It is bilateral because digital technology is a production of cognition, and today this requires digital assistance. It is dual because these relations concern both the individual and the communities. We will therefore differentiate between the technologies of personal tools and embedded hardware, and those of the Internet of Things, networks, and communities. These are two distinct but complementary fields of cognitive warfare.

4.3 LIMITED CAPACITY AND ATTENTION

One of the first things to be noticed about cognition is that it has only limited capacities within the already restricted range of what the brain can know about the world. It concerns both the quantity of information to be processed and the energy directed on the contents of this processing. The little information that reaches the sensors is manipulated by internal filtering processes whose purpose is to protect the brain from overload and to increase the salience of what the brain is processing.

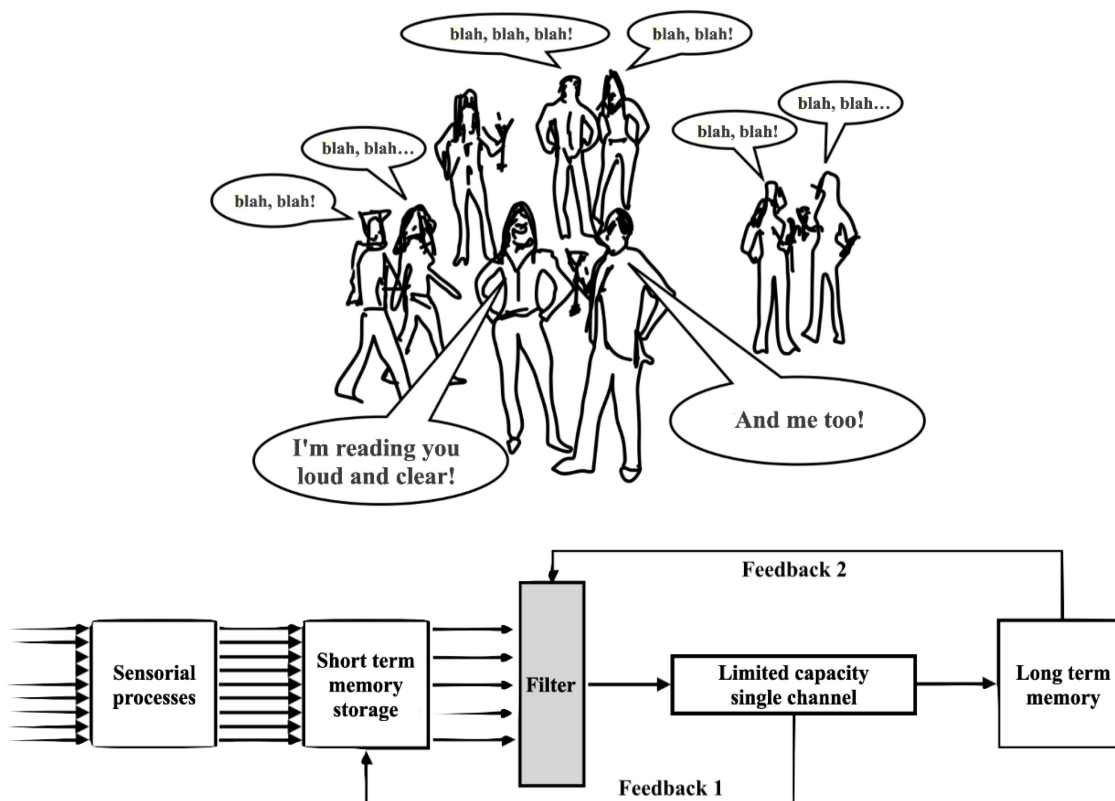


Figure 4-5: Illustration of the Principle of Information Selection to Protect the Cognitive System with Limited Capacity – the Selected Information or the Information Having a Significant Force Passes; the Non-Useful Information is Neglected. Experience of the “cocktail party”: one hears what the interlocutor says without hearing the others unless what they say is significant, then one does not hear the interlocutor (one does or does not pay attention).

The attention phenomenon has several characteristics. It is a function of the type of information, its physical intensity, and its semantic strength, but it can also be voluntarily oriented towards certain dimensions of the information. In the first case, we speak of a “floating attention,” with cognitive mobilization depending on the characteristics of intensity or meaning of the afferent signal. In the second case, we define a “directed attention” towards expected characteristics. From this, we can conceive that attention directed towards a target limits any attentional capacity to other destinations. One then knows of the world only what one expects of it.

If this organization of the cognitive system protects against information overload and ensures the efficiency of what is selected, what is outside the attentional field escapes processing. This is what we observe, for example, in distracted driving while using cell phones, or in the tunnelization effect in air traffic control, during which what happens outside the focus of attention escapes the sagacity of the radar operator. Such examples are to be found in applied psychology textbooks, and the implementation of visual scanning procedures imposed on operators, pilots, surgeons, and other experts involved in surveillance duties, is systematized in training courses. These procedures are themselves very costly in terms of attentional resources, very tiring, and require a collaborative organization of the workstations, with digital devices to assist, substitute and monitor the human actors.

The distraction domain is one of the main aspects of cognitive warfare. It has two complementary components: attentional pollution with the distraction of focus, and the exploitation of digital flaws or interfaces of digital assistance or monitoring tools. Thus, the repeated occurrence of multiple alarms with no object of interest leads the operator to minimize the significance of these alarms, or even to neglect the device itself or even disconnect it. Numerous accidents have been caused by a do-it-yourself approach to the suppression of alarms (in hospitals, energy control, air navigation, road, or domestic accidents, etc.).

4.4 COGNITIVE CONFLICT AND ILLUSION

A cognitive conflict is a situation that an individual must manage by processing information for an expected purpose that is not consistent with what that information allows him to do. This is the case when the processing is incompatible with the expected result or raises a cognitive ambiguity that the subject cannot simply resolve. For example, this is the case for ambiguous figures that are perceived as mutually incompatible shapes or that lead the subject into a task that is impossible to resolve.

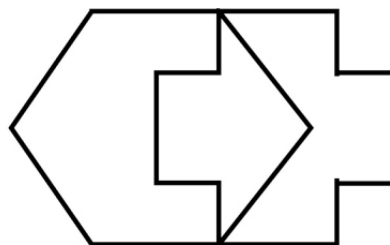


Figure 4-6: Does the Arrow Point to the Right or the Left to Reach the Pharmacy? And is it a hexagon or a cross? Examples of ambiguous figures that require a lot of cognitive work in order to answer a simple question.

This type of figure was documented early on by Gestalt Psychology (Köhler, 1969) and has been the basis for many studies in psychology and neuro-ophthalmology (e.g., Meng and Tong, 2004; Kawabata and Mori, 1992). The time used to resolve the cognitive conflict is not available for anything else and the conflict often becomes obsessive, engaging future reasoning (see Figure 4-1 and Figure 4-5). Cognitive energy directed towards surface problem solving increases the psychological cost and reduces the resources to be allocated to other tasks.

4.5 HIERARCHIES AND COGNITIVE DOMINANCE

The cognitive system is globally structured into functional levels whose activity is complementary and combined with that of the others to produce an adapted behavior. This organization corresponds to the emergence of new encephalic structures during the evolution of vertebrates. Thus, cognition appears as soon as the animal becomes capable of understanding its environment, of being “aware” of it and of using its experience to better adapt to it, thanks to strategies that it invents: an “intelligence.”

Intelligence is to be understood here as “the ability to solve problems that cannot be solved by themselves,” for a better adaptation, a better survival, a better longevity and a better quantity or quality of pleasure (Claverie, 2005). Cognition is closely related to intelligence and awareness of the world. It is already present in humans’ ancestors. They have kept particular aptitudes, which they have perfected to give the most sophisticated functions, such as symbolism and language, and self-awareness.

The cerebral system supports the cognition, from the most elementary forms to the highest. It represents a stack of successive levels of development, with properties that are complementary, sometimes antagonistic, and more and more elaborate for a more and more complex and better adapted behavior. It is surrounded by the inputs and outputs of the sensory-motor system and part of the endocrine system (some hormones are involved in stress, vigilance, and attention).

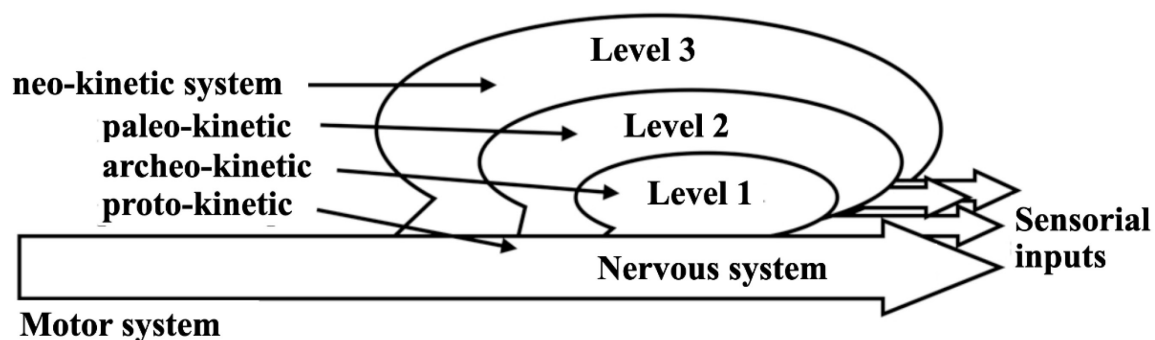
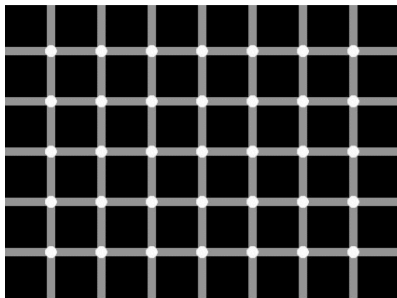


Figure 4-7: Simplified Diagram of the Cognitive Levels Organization on the Brain Layers, Between Sensory Inputs and Motor Outputs. This cerebral structure contains the nervous entities responsible for the different cognitive functions indicated in Figure 4-1 Note: kinetic, from movement (Greek); literally which allows movement and by extension adaptation to the environment by sensory integration and motor programming.

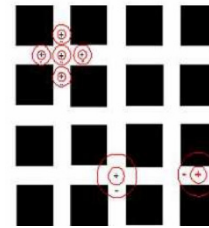
The brain is therefore a hierarchical device, organized in levels and expressing cognitive functions and thinking skills that are increasingly powerful.

The simplest level represents a first level cognition linked to automatisms, with sensory limits, programmed skills, rudimentary memories, etc. It is the level of basic learning, of the establishment of all-or-nothing processes, those that no longer require attention once established, but escape all control once triggered. This level is particularly easy to deceive. It is involved in illusions, bad perceptions, false certainties, and the induction of motor automatisms. The second level is strongly dependent on the processes of memory and affectivity. These two components of mental life are in close collaboration, involving the functioning of very close structures (amygdalo-hypocampal complex, Papez circuit, cingulate cortex, etc.). The manipulation of one of these components affects the other, and it is easy to stabilize parasitic memories by affective involvement and to trigger emotional reflexes by imposing memories. Three different challenges have to be met so that the operational suggestion we wish to make here can be followed.

Other dimensions of cognitive warfare can concern the modification of the elaboration of stored rules by information or decision overload, by accelerating analysis loops that do not allow the elaboration of procedures or, on the contrary, by provoking conflicts of these rules. An example can be given in the difficulties of background/form detection or the use of a process that inhibits another one.



The contrasts perceived at the intersections are attributed to the variation in the frequency of the action potentials according to the relative areas of the retinal regions called ON and OFF (primary visual receptive fields).



The neural coding frequency is maximal when the ON region is fully lit and the OFF is completely dark.

Figure 4-8: How Many Black Dots Are There in the “Hermann Grid”?

Figure 4-1 and Figure 4-5 are ambiguous. Their analysis depends on low-level rules that exclude each other. The factorization of one of them prevents the other from being expressed. Even if we know it perfectly, we cannot have any control over it; we cannot see both forms at the same time, which is elementary for a machine. In the same way, certain inferences can facilitate certain processes with, for example, the overestimation of the verticals compared to the horizontals. This is also the domain of “nudges,” those “little nudges” that are nowadays introduced almost everywhere to guide and orient behavior (Thaler and Sunstein, 2009) in a form of constructive manipulation of behavior, well known in management and in road or industrial safety.

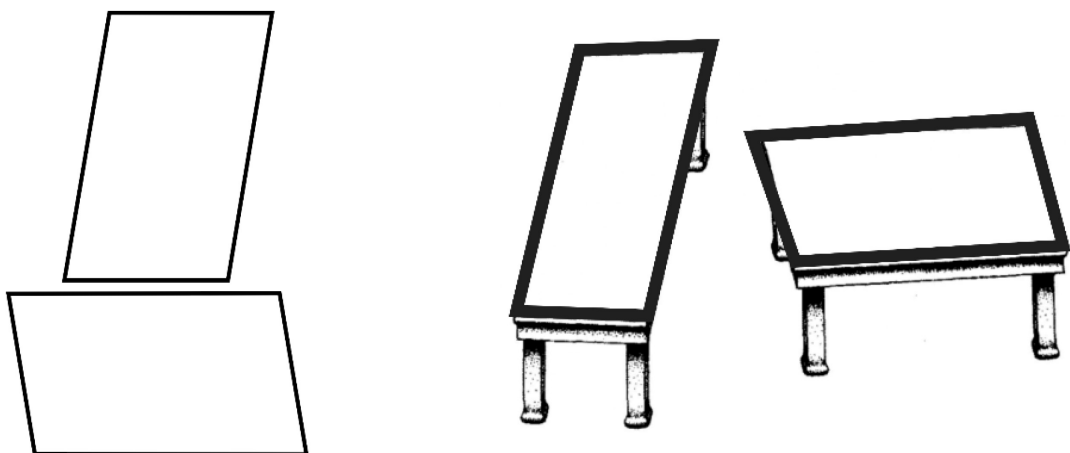


Figure 4-9: Example of Two Perfectly Identical Figures Whose Difference in Orientation Makes Them Appear to Have Different Dimensions and Surfaces. (Right) The contextual effect of “Shepard’s tables” (1990). This illusion combines the analysis effects of first level (visual), second level (context) and higher level (semantic).

The higher cognitive level is mainly involved in semantic strategies, using language or symbolic meanings. This is the level of explicit consciousness or repressed unconscious phenomena, of mental images and sophisticated representations. It sometimes competes with the lower levels with the use of automatisms or rules learned in a voluntary effort of cognitive orientation.

It is also the level of high-level biases concerning ambiguities of meaning, either due to a lack or an excess of meaning, a semiotic conflict, or semantic ambiguities. Several theories exploit these operating distortions. They can be found as early as the end of the 1960s in experimental sociology (Zajonc, 1968), then in numerous works of social psychology (Goffman, 1974), in experimental economics (Martinez, 2010), as well as in risk ergonomics with a particular focus on “absurd decisions” (Morel, 2002) and the strength of the “counterintuitive” (Berthet, 2018). They were notably popularized by the Nobel Prize-winning economist Kahneman (1979) and his colleague Tversky under the name of “cognitive biases.”

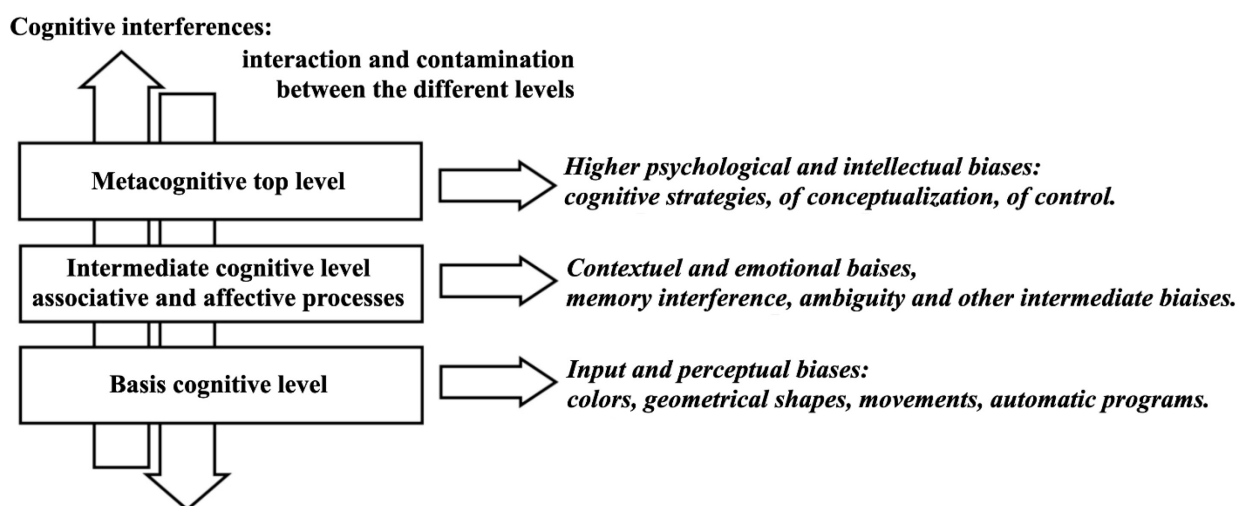


Figure 4-10: Organization of the Cognitive System in Levels, with a Hierarchy of Cognitive Biases Based on the Levels as Well as on the Interaction Between These Levels.

Just as cognitive processes are hierarchically organized into functional levels, such as language and high-level formalism, affectivity and memory, feature extraction and perception, the relationships between these levels are equally important in contributing to a global knowledge of the environment and its awareness.

The conflicts within each level are then completed by conflicts between levels. As the processes enrich each other, they can interact in an inhibiting way by preventing a task from being carried out, for example, or in an exciting way by distorting the productions. These phenomena are at the origin of semantic misconceptions linked to erroneous bottom-up processing, which may or may not compete with data in the memory. The same applies to top-down processes that tend to direct attention and let us know about the world only what we expect from it, minimizing the importance of unexpected elements and neglecting weak signals.

4.6 COGNITIVE PERSONALITIES AND STEREOTYPES

The cognitive personality is the spontaneous way an individual has of knowing the world. In a way, it is the set of habits of thinking, seeing, hearing, memorizing, etc. Each individual has a tendency to mobilize, prioritize or, on the contrary, inhibit certain cognitive processes more than others. This personality is particularly related to the distribution of priorities allocated to each cognitive level, but also to the habit of

facilitating or inhibiting the interrelations between levels. The world is thus conceived and known in a different way according to the criteria of the cognitive personality of the individuals who explore it, insert themselves into it or speak about it.

One of the criteria is the priority given to one level over another. Some individuals tend to value concrete sensory information to the detriment of the emotional or memory value of each of them. Others focus on their interpretative conceptualization, modulated by language or by intellectual theories learned. Another example is the tendency to focus on details while others focus on wholes, or contexts versus isolated elements, etc. Some people have a greater tendency to intellectualize their perceptions and to retain only what is analytical or constructive, for example the preference for numbers over words or vice versa, for geometry over logical relationships, for series and regularities over novelty, etc.

At the higher cognitive level, which is considered to be dependent on the cortex of both cerebral hemispheres, cognitive differences are known according to the laterality of the processes: the cerebral dominance. Some cognitive personalities depend on processes considered to be lateralized on the right, while others favor those on the left. The commissures (relations between the two hemispheres) can be more or less solicited with some individuals being more bilateral than others.

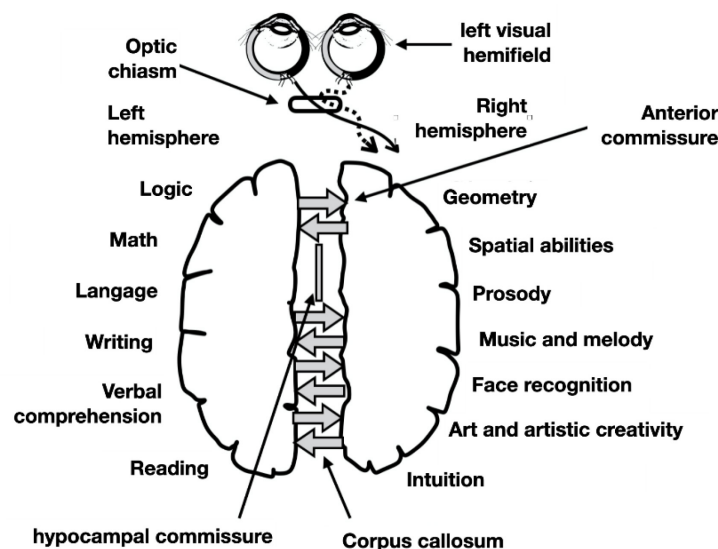


Figure 4-11: Example of Lateralized Cognitive Functions Recruiting Different Neurofunctional Territories, on the Right or on the Left, Forwards or Backwards (here in the Right-Handed Person). Spontaneous cognitive dominance processes contribute to cognitive personality.

Therefore, the world is not as our brain allows each of us to conceive it, nor as another can conceive it. It is through language that a linguistic negotiation about it is possible. It allows us to understand each other and thus contribute to its theorization. This metacognitive dimension serves both as a guide and as a facilitator of the cognitions linked to the lower levels. Such top-down processes, influenced by experience and culture, constitute a real model in which knowledge is embedded. They form a kind of prototype of thought.

Thus, it is easy to use distortions between individuals, to facilitate the lack of coherence between conceptual models and personal knowledge. The field of failed learning is concerned here, but also, in a more critical way, that of certain abductions or psychopathological disorders that are as difficult to control as they are simple to induce and exploit.

4.7 CAUSAL ATTRIBUTION AND MANIPULATION

The attribution process is based on causal inference. This means that at the most sophisticated level of thinking, an individual does not objectively infer data or seek an interpretive solution through a trial-and-error process. The individual interprets the world according to previous mechanisms, prototypes, and spontaneous beliefs. Attribution makes it possible to give meaning to events, especially when they are complex and when there are no simple explanations. It concerns both the individual's own conduct and behavior and that of others, and this applies to the interpretation of the past as well as to predictions, spontaneous expectations, and the interpretation of the future (Heider, 1958). Two dimensions are to be taken into consideration, that of the context and the organization that is believed to be the environment, and that of the individuals and the importance that they consider to be their role in this future (Jones and Davis, 1965; Nisbett and Ross, 1980). Two dimensions of attribution are thus identified. The first consists of believing that the evolution of the situation is mainly relative to oneself, to one's own choices and behaviors, or even to one's mere presence: this is "internal attribution." The second is to believe that almost everything depends on the environment, history, or others, that the context is predominant and that personal action is of little importance: this is the "external attribution."

We have seen that decision makers are constrained by their attributional tendencies, often based on their work history and experience, but also by their biases. When facts contradict the attribution, some of them maintain their judgments by confirming the pre-established explanation and by authoritatively denying alternative hypotheses.

The constitution and the systematic recourse to "ready-made ideas," in particular in human relations with the recourse to "naïve psychological theories," allows the individuals to inscribe themselves into a reassuring framework of understanding of the world. The importance is no longer to know something exact about the world, but to ward off uncertainty with "spontaneous theories" that their authors try to confirm at all costs. Some slippages can even lead to "fake news," false controversies, revisionism, and contestation of science, etc.

One of the usual principles consists in a filter of analysis that permits only the facts of reality that confirm the convictions. Everyone draws conclusions about the future from selected samples of the past. The rules make it possible to consider the events of the world as particular cases falling under the interpretation due to these rules. For each of them, the deviations from the rule are considered as exceptions which constitute the basis for the elaboration of new interpretative rules of reality, participating in a bias of self-conviction. We can therefore reduce the problem of cognitive personalities, i.e., the tendency of each individual to spontaneously mobilize certain cognitive processes, according to the main bases of causal attribution: the dimensionality of the "self" distributed around the two poles of hypertrophy and personal miserabilism; the feeling of responsibility, passing from the orientation of the cause towards oneself to the feeling of persecution; the falsity of the judgment which rests on inadequacies of the forms of reasoning.

This is where the shift from a science of cognitive biases and the personalities that are subject to them to clinical psychology begins. These attribution biases are indeed characteristic of many psychopathological disorders. They are the object of a systematic expression exploited by certain manipulators.

4.8 BIASES AND GENERALIZED ERROR

Some authors have studied several forms of bias. One particularly interesting form is the so-called "complacency" bias, in which the interpretation of reality is linked to the potential positive or negative outcome of a situation (Nisbett and Ross, 1980). Moreover, there is a difference in position depending on whether one is an actor and involved, and an observer or not concerned by the situation. Thus, the actors involved attribute more causality to the "me," to personal motivations and to the valuation of the potential

effects of their own action, whereas observers or external collaborators value dispositional and contextual causes, while minimizing the importance of the people involved and their action.

In both cases, the bias of “pretentiousness” consists in thinking, for an individual, to be at the center of the problem or on the contrary not to be concerned by this problem. Misunderstanding, or even contempt, are spontaneous consequences of the one in relation to the other and are factors of social ostentation and even of interrelational problems. The expression of a hypertrophy of the self is often concretized in a form of conviction of uniqueness, of belonging to a kind of elite, while being convinced of impermeability to the considered bias. Another usual form of expression consists in believing that training can transform one’s personality and thus protect one from the bias. These two positions often combine to give rise to or justify corporations, collegialities, professional communities, even factions and other elitist organizations. They pose the problem of practical training, by example, or within the framework of an initiatory “enlightenment.”

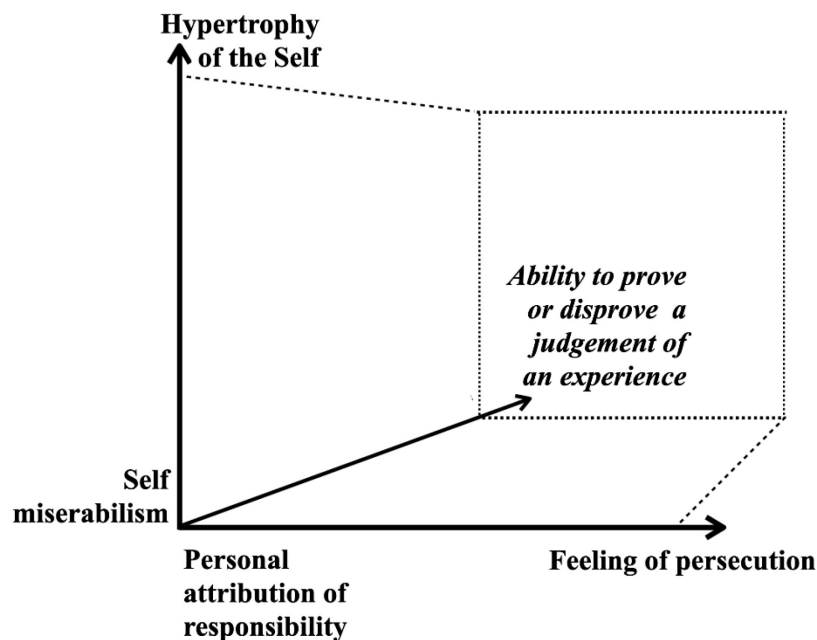


Figure 4-12: Three Clinical Axes of Cognitive Distortions in Causal Attribution. At the bottom, front and left, biases tend toward melancholy and withdrawal. At the top, back and right, paranoid personalities. At the bottom left, biases of pretentiousness at the top, or self-indulgence at the bottom. At the top, in front and on the right, the meticulousness biases, etc.

Two other beliefs, as common as they are erroneous, are that only others are victims of cognitive errors, and that formalism and training will solve the problems of bias. However, everyone is concerned by the perceptual error in Figure 4-8 and Figure 4-9, and it is not because we have a rational explanation for it or because we repeat the experiment that the error disappears. Only the knowledge that one has of the error and the knowledge of how to control its consequences can be useful. The cognitive system does not vary; it does not evolve with experience or with learning, and its biological characteristics mean that everyone, without exception, is affected. Experience or training do not change anything. The only things that can be learned are therefore self-control or shared control, and metacognitive analysis of anticipation (“gaming” and simulation) and catch-up (“dynamic retex”). But as soon as the lower levels are involved, as soon as the mental load, stress or time pressure increase, individuals tend to revert to their stabilized cognitive bases.

Cognitive biases are general errors. Behavioral economics has inventoried hundreds of them. They are all based on the structure of the cognitive system as it has been constituted, subject to the neurobiological

constraints of evolution. This has facilitated the emergence and selection of processes useful for survival, eliminating individuals who were not subject to this logic. Two major biological principles are at work. The first is the tendency to “minimize energy.” This major biological principle manifests itself in optimization of the spontaneously estimated “cognitive cost.” The individual unconsciously values short reasonings and one of the motors of this regulation resides in the motivational conviction that simple thoughts are the most truthful. Once established, spontaneous representations, beliefs, and stabilized thought prototypes contribute to certainties that interfere with objectivity or commit the individual to the constraints of another principle: having to make choices. A cognitive choice is an abandonment of thought, and it is difficult to abandon what one holds dear. The learning of explicit rules makes it possible to avoid ambiguity. Their concatenation to solve complex problems mobilizes both memory and attention, as well as the reflection to know how to choose and order them.

These are three targets of cognitive action. At the first level, it is a question of saturating attention and exploiting automatisms, at the second level, of disturbing memory and exploiting emotional influences and interferences, and at the third level, of preventing the realization of reasoning by temporal pressure, interference, or facilitation of reasoning errors.

4.9 EXPLOITING COGNITIVE ERRORS

As far as reasoning is concerned, it is often false. To put it simply, we can consider that human thought is based on the implementation of three types of reasoning, two of which are useful, or even indispensable, but erroneous. It is then simply a matter of facilitating them.

The simplest and most frequent type is called abduction. It is also the less expensive one, which we suppose corresponds to the basic forms of the cognitive system. It is the constitutive mode of thinking of a naive physics and of spontaneous psychology. These two dimensions of knowledge allow each person to have a simplified form of understanding of the world and to establish natural relationships with others. It is probably linked to the immediate survival of individuals, with rapid knowledge based on the categorization of life contexts and that of dangers or resources. In psychology, abduction is the main form of intuitive reasoning; it consists in minimizing troublesome hypotheses by saving cognitive costs, and eliminating solutions considered improbable. But abduction, however efficient, is a logical error.

This reasoning is based mainly on observation and experience. It is an abusive generalization of causes. This reasoning is very useful if it is controlled, used in science, to make a medical diagnosis, or to investigate and motivate the “intimate conviction” of magistrates. However, abduction does not lead to a reality, but brings a “probable truth” that needs to be explored and verified a posteriori thanks to strict protocols. But this verification takes time and can appear superfluous. Abduction produces error through naivety or through accepted risk since it is considered improbable.

A second, more sophisticated level of reasoning is called induction, which is also a logical error. It falls under the same characteristics of usefulness and criticality of consequent non-verification. It also contributes to a representation of the world by the elaboration of spontaneous categories which allow the subjects a more sophisticated representation than with abduction, although also naive.

Induction is mainly built around time assessment. It is the belief that the future will look like the past and that we can expect stability in reasonable time frames. “Tomorrow there will be daylight,” “the night is young” and “the sky is stormy” are useful examples for a normal life. It is a tendency to make a generalization, with an explanatory role for the future, based on past or established events, ignoring exceptions. This form of reasoning goes from the singular to the general, from the particular case to the laws that would govern it, from a consequence to the principle from which it would follow and to a postulated cause. This type of reasoning has also shown its interest and power in science, medicine, and

economics, as long as the thought process is limited by the qualification of the probability of one's own error (internal validity) and the permanent search for a counter-example that would refute the generality admitted, however without certainty (external validity). Here again, there are two weaknesses of reasoning, the introduction of false beliefs from erroneous elements or the neglect of exceptions and counter-examples often present in weak signals.

Abduction and induction are opposed to deduction which, when correctly formulated and established on verified elements (truth of the premises), leads to a conclusion that is always true (truth of the conclusion).

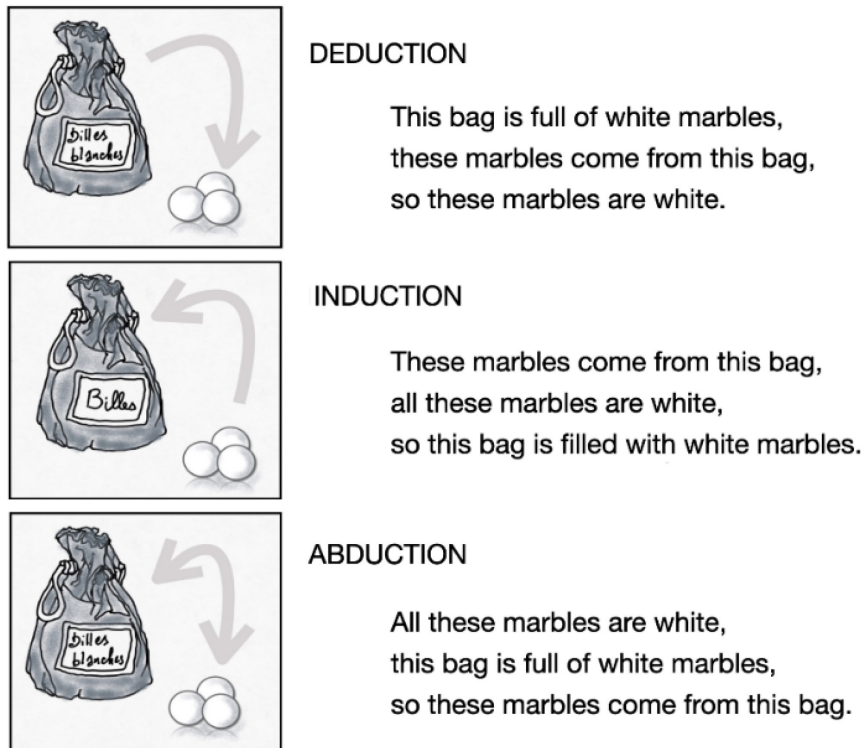


Figure 4-13: Three Forms of Thinking. The first one needs time and has only a weak power of generalization. It is however the only exact one. The other two forms of thinking correspond to cognitive reflexes and are logical errors inducing psychological biases and spontaneous psychology rules (folk psychology). Their usefulness can only be considered if accompanied by methodological procedures of verification, which are costly in time and energy (in Claverie, 2019).

Generally speaking, cognitive errors can be related to these three categories, or to a combined sequence of elements of these three types of reasoning. It is then sufficient to identify the constituent elements of the opponent's cognitive strategy to act on at least one of them, by exploiting the constraints of speed of thought and non-verification, the tendency to neglect these verifications, the facilitation of abusive generalizations, and the confirmation of erroneously established convictions. The defender, on the other hand, takes care to value the steps of deductive verification by chasing away the recourse to shortcuts of thought, notably by detecting the potential flaws of reasoning or doctrinal or established procedures and rules.

In the future and faced with the brute force attack and the difficulty of spotting it, the double necessity of a strict methodology of reflection and the use of artificial intelligence tools and analytical programs on big data will emerge, on the one hand in the surveillance of cognitive errors and on the other hand for the detection of malicious actions of incitement to error.

4.10 METHODOLOGY AND CRISES OF UNDERSTANDING OF THE WORLD

While thinking is a spontaneous act, thinking professionally is not something done without careful consideration. For example, medical diagnosis is not a simple impression, resulting from floating attention and the emergence of information memorized by the patient or the practitioner. The diagnosis is subject to strict rules of prompting, directed questioning and structured analysis. It proceeds by going back and forth between abductions, inductions, and deductions, focusing on elements to be eliminated or, on the contrary, to be valued. Complementary examination takes on its full meaning here in the completion of the opinion. The same is true today of criminal profiling techniques that abandon impressions in favor of scientific, strict, and logical methods that can be accepted by the courts.

This procedure is well known in science. It focuses on looking for elements of refutation to a theory in order to refine its edges. The elements of theoretical falsification are then examined and are the object of a specific research, either to refute the general theory or to clarify it. This method works by conjectures and refutations (Claverie, 2019).

We can schematically describe the reasoning process by one or several hypotheses posed by induction or abduction, which allow predictions that must be confronted with real experience. They are then refuted or accepted as potentially valid until a new contradiction is found. The truth is thus only temporary. It is admitted within the framework of a permanent vigilance to be invalidated or reconsidered. Outside this strict practice, it is the domain of error and the potential playground of cognitive warfare.

Objective knowledge of the world is first of all based on generalities. They are constructed from statistically established data, verified information describing notably central tendency values. They explain the totality of these values, and the best part of the marginal data, some of which may however conflict with them. This is where the problem lies, since an explanatory theory of reality, i.e., its representation, is by essence transitory. It is constantly being refined and enriched. When it can no longer be refined and enriched, it must be abandoned, despite the investments that have been made and the personal convictions, however established.

A famous example is offered by the epistemologist Karl Popper (1959), who developed the paradigm of the critical rationalist. A theory states that all crows (birds of the *Corvus* family) are black. However, a weak signal produces a crucial experience: a white crow has been spotted. In the first case, it is either an error or a cognitive disorder (e.g., observation error or perceptive illusion), or there is a crow, which temporarily was or became white (e.g., became white by old age), or somebody made believe that a white crow exists (e.g., by painting a crow white, by building a false crow out of white cardboard, by altering the observation instrument, etc.) In the first case, the veracity and informational robustness of the observations, the observables and the observed, as well as the reliability of the observers, must be re-examined. Second, the sources and sensors, as well as the signal filtering and amplification procedures, must be checked for cyber confidence. One can also highlight a transient aspect of the observable, or a harmful intent and the existence of a malicious actor. Although the theory has become inaccurate, it is being adapted. It must then evolve by conceptual refinement or clarification: all crows are black, except for albinos, which will then have to be the subject of a theory of their own, or except for those painted white, or except for old birds, etc. If it turns out that the successive refinements cause the theory to lose all meaning, it will be abandoned because it has become incapable of describing and explaining reality: white crows do exist.

Abandoning established theories is costly, and especially anxiety-provoking if no alternative theory is available. It raises notable resistance among the followers of the theory as well as among its users, who will have to modify their conception of a part of the world and their experimental procedures attached to it. In science, this crisis opens up an epistemological revolution, in sociology it opens up a conceptual revolution, and everywhere it opens up a crisis of representation and of interpretative models of reality. It is therefore wise to flank any certainty with secondary interpretations which can then serve as a basis for a new conception of reality.

There too, it is possible to theorize several dangers of cognitive warfare into which it is easy to fall. The first is the accumulation of false certainties, by repeated induction or abduction, without possible verification. This leads to the development of a form of belief in an erroneous model. The second consists in using the accumulation of counter-examples to disguise one of them that will go unnoticed, for example by disguising a white crow as black. Finally, the saturation of analysis time lies in the culture of ambiguity, with all the ranges of grey crows. Preventive measures are all the more critical as they are difficult to anticipate.

4.11 THE LIMITS OF COGNITIVE POVERTY

Cognitive warfare is therefore the art of deceiving the brain or making it doubt what it thinks it knows. Its playground is the domain of the limits, constraints, and stereotypes of human thought, of false theories and of the culture of error in which it leads the opponent. The alteration of cognitive processes serves as a basis for a real action that is facilitated by the power of the digital. To conceive even this action is not easy. And it meets resistance from operators as well as decision makers. In this new war of theories, practices and doctrines are not evolving as quickly as technologies and the creativity of those who use or abuse them. For the time being, several problems are obvious.

The first of them is the problem of discretion and lack of sensitivity. The cognitive strategy is not public and it remains “local.” We only notice its effects, and its validity is only established after the fact, often when it is too late. The second problem lies in the spontaneous incapacity of the human brain to conceive that it is itself subject to constraints, preferences, and limitations, which can be the object of external action. This incapacity implies that it is not because we know that we think badly that we will think better. Knowing that the two forms of Figure 4-9 are the same does not help us to see them as equal. And learning can do nothing about that. Nevertheless, we can pay attention to it and try to control our thinking or that of our collaborators, eliminating false certainties and valuing those that are proven.

Another problem is the easy confusion between the real world and the digital world. It is not because the digital world tells us about reality that it is anything other than a digital truth. It should be interpreted as well as possible for the most concrete action possible. This digital world can itself be the object of distortions, omissions of all or parts, or on the contrary of additions or spontaneous or induced illusions.

There is also a confusion between correlation and causality, or a confusion in the meaning of causality, due to the temporal confusion characteristic of human thought. It is spontaneously abductive, even inductive, whereas the only truth emerges from deduction. Reasoning or deductive verification takes time that is often not available to the actors. In many cases, the time allotted to reflection is limited, too short to mobilize rational processes, thus valorizing even more partially erroneous forms of thought, which nevertheless often prove to be effective. Here lies another danger. Repeated observations and habits of thought lead to a kind of conjurative, automated cognitive activity from which one cannot escape without discomfort, anxiety, or refusal of uncertainty. Cognitive biases are forms of intuitive reasoning that consist in minimizing improbable solutions and looking for spontaneous general laws from particular facts. This notion is opposed to a logic of systematic exploration that is both time-consuming and energy-consuming, and to which the majority of people refuse to submit.

Finally, the negligence of weak signals seems to be a cognitive constant. Generally speaking, it is a necessity, and those who are subjected to the prevalence of weak signals are incapable of normal thought. Yet, the details are often important and the “white crow” can be a major clue to the conduct of healthy thinking. Yet it is neglected, even denied. The negligence of weak signals is probably due to a Western culture of simplification by “trimming,” the conviction of which has made the headlines of a certain “idea of the essential”: “Occam’s razor” has become the purveyor of a well-shared skeletal thinking. Weak signals are, however, the places where certainties evolve. It is in the edges that innovations emerge, and the devil is also often in the details. On the contrary, the obsession with detail becomes a handicap, channeling on it the attention left vacant for other elements, partial or global.

4.12 THE C2 COGNITIVE TARGET

The process of conducting military operations is referred to as C2. This acronym stands for “command and control.” It is an organized set of regulated processes, adapted to the management of a crisis situation. It allows for the implementation and execution of a strategy that consists of transforming objectives into concrete achievements that contribute to the realization of a desired end state, thanks to the execution of adapted lines of force.

C2 is considered as a device mobilizing several bases of human intelligence (Alberts and Haye, 2006). Its core is a set of cognitive processes supported by three pillars: informational dominance, information processing security, and decisional superiority (Desclaux and Claverie, 2015).

C2 is the heart of the military machine, from information to decision for the respective minimization and maximization of concrete as well as immaterial forces and powers, those of enemies and allies. It is theorized as a true cognitive machine (Claverie and Desclaux, 2016). It is therefore the place of all fragilities, and it requires all attention and precautions. Those who neglect it will be the ones who regret it tomorrow.

Indeed, C2 can be applied to the handling of complex situations, such as industrial or ecological accidents, crowd management, or unilateral conflict, but it takes on a new dimension when it leaves asymmetry. The return to high-intensity conflicts would then become a C2 battle, and superiority concerns both the best strategy and the best conduct of the strategy. The cognitive error becomes a strategic alteration. This is one of the lines of force.

Cognitive warfare becomes a tool to reach, alter or influence strategic thinking as well as the cognitive elements of its implementation and future life. The aspect of decisional superiority becomes the privileged target, relying on the two other components of psychological and cyber action.

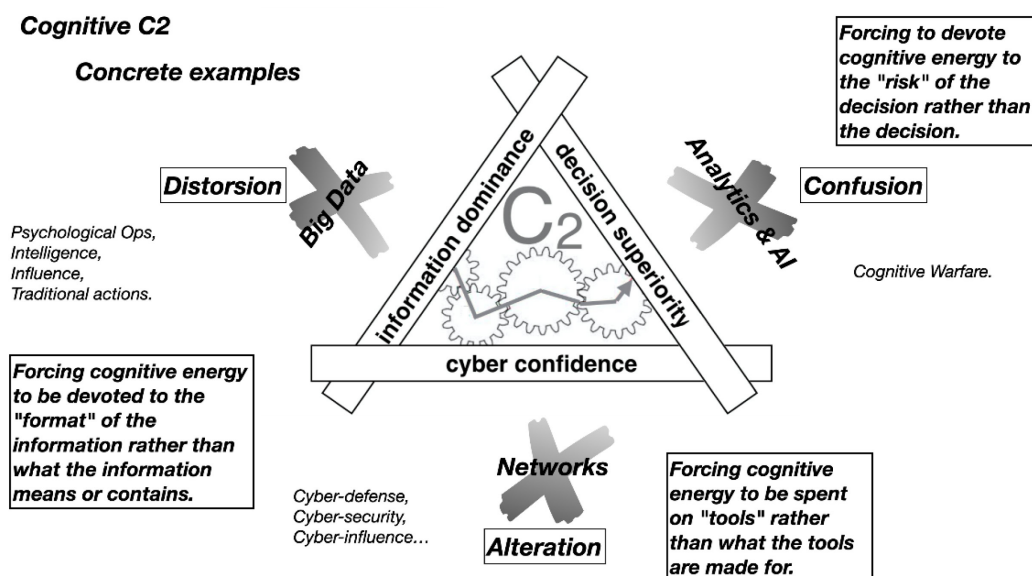


Figure 4-14: The Cognitive Triangle of “Command and Control” (C2) with the Three Bases of Informational Dominance, Cyber Confidence and Decisional Superiority Processes, Along with the Modes of “Cognitive Warfare” Action Using the Complementarities of PsyOps, Cyber-Influence and Cognitive Superiority, and Possible Modes of Attack. (From Claverie and Desclaux, 2016).

4.13 CONCLUSION

Cognition is the object of particular attention from strategists. It can be defined as the set of processes, mechanisms and actions that allow us to know the real world in order to act on it. Each of its dimensions is the object of particular interest in terms of military action and defence. Knowledge is necessary for action and action is necessary for survival, conquest, or dominance. It imposes filtering, memory, categorization, and semantic comprehension, as well as communication for their exchanges in the collective action. These are all dimensions of cognitive life. Meanwhile, action requires strategy, anticipation, and programming. Behavior is part of the necessary loop of control and of its representation for adjustment. The motivations are similar; dynamic appetite and cognitive appetite; move to grow and survive; move to live and know.

Why make it a content of war? Cognition is at the base of the action of the combatant as well as the commander. It is part of the dimensions of tactics and strategy. Cognitive warfare is a tool to reach the cognition of those who lead, make, or avoid war. In a way, cognitive warfare constitutes a three-dimensional set (information, numerical and decision) to reach the cognitive elements of the military operator's thought as well as the strategist's, in a psychological, cybernetic, and cognitive complementarity.

The natural and spontaneous cognitive resistance to admit that one might be affected or that education, training, or habit are inadequate to deal with cognitive distortions, as well as the energy and investment costs of parallel prevention processes, which are considered superfluous, are the two best allies of the cognitive warfare actor.

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