

Thought and Rational Thinking...

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As I have often heard people oppose “rational thinking” to other modes of thought, I arrived at wondering what they might possibly mean by “rational thinking”. Most especially because, although a surrealist, a computer scientist, and even a bit of a mathematician, I never felt the least schizophrenic. So setting aside all that is usually said about this subject, I began to have doubts: What is “rational thinking”? In which way may such a thing exist?

In the field of English texts, as regards rational minds, one must invariably consider Sherlock Holmes, his imperturbable logic and the famous (albeit apocryphal) "elementary my dear Watson!". It must be noted that police literature is often considered as the very exemplar of practicing rationality and logic. Yet, if I stealthily shift from the British arena to the French arena, trying to recall the rare relations I ever had with detective novels, what immediately comes to mind is the old French television series *The Five Last Minutes*, the well-known *Inspector Bourrel* and "*Good God! But of course it is...*" which showcased the right-on-time fulgurance by which the culprits' identity suddenly blossoms in the mind of the good inspector, out of the chaos of the on-going investigation, five minutes before the end of each episode. And then, during the next five minutes, came the explication, all logical of course, thus “righting the universe”..

I am surprised that Inspector Bourrel, a cartesian Frenchman as all French are supposed to be, can avail himself of a flash of mind where his British counterpart tries to convince us that he follows step by step the slow, patient and methodical way of reason. So that an evil spirit suggest to me that Albion could in this case send us one of its perfidies, while on the other side of the English Channel we, French, would be no less Frank than our ancestors were ¹. But it also comes to my mind that in both cases, whether in Holmes the elegant or in Bourrel the gruff, reason and logic only come at the end.

The bird of Minerva takes flight only at dusk
G.W.F. Hegel.

The owl takes its flight only at twilight, no doubt, but not Minerva -- whose birth is to be remembered -- sprouting out of Jupiter's brain with weapons, helmet and shield ... Which seems to give the point to inspector Bourrel, while the elegant and felted flight of Sherlock Holmes's

1 It has been objected that I exaggerate, and that intuition and fulgurances also play their part in the progression of Sherlock Holmes' thought . Of course ! But what I am talking about here is not the reality, but the way it is spoken of.

owl would reach the first place only as a consequence of the fulgurances of Minerva herself. So that, the owl only perches at the end of a tale: the always late and conclusive *narrative* of logic.

Descartes

But of course we need to ask Descartes ... I had to re-read Descartes due to a late discussion with one of my colleagues who was teaching software design. At the time, structured design (also called Top-Down approach) was very fashionable, in which, a main program supposed to carry out the work to be accomplished called subprograms which carried out certain subtasks and which themselves called sub-sub-programs that performed sub-sub-tasks, etc. In total, the work to be carried out involved a whole tree of tasks, subtasks and sub-sub-tasks. This approach - which the reader clearly feels owes much to René Descartes' Discourse on the Method - has since then almost fallen into disuse for the benefit of what is called the object-oriented approach that more closely resembles the work of a novelist or a theater author who imagines the text of his work on the basis of the interactions of a few previously defined characters or whose definition gradually refines as the mature work.

The question I raised with my orthodox colleague, the ardent zealot of the Method of the Discourse, was the following : "I understand," I said, "that by cutting the problem into smaller and smaller pieces, we finally get little bits of solutions that solve little bits of the initial problem, and that in assembling these little bits of solutions, there is a good chance that the initial problem will be solved. But what makes us sure that the solution thus obtained is optimal? ". The word optimal in an industrial context only exists in a few well-identified dimensions, which are generally: performance, costs, lead times and quality. But we could just as well choose other dimensions for optimization, such as the "adresse" (skill) dimension that Marcel Duchamp has very well illustrated in the *Nine shots* part of his *Great Glass*.

As my colleague did not seem to be able to give me a satisfactory answer, preferring to refer to God rather than to His saints, I went to see if Master René Descartes had an answer to give me. But I have not found any. On the other hand, contrary to what many of its zealots state, Descartes' Method is both top-down and bottom-up. Descartes, as opposed to his forgetful supporters, has also thought of how to reassemble the pieces into a whole, in other terms, he thought of what is called Integration in the fields of Systems Engineering (and in that of Software Engineering too). Integration is not always an easy matter, and it must be admitted that the deployment at the level of a

whole country of complex systems developed by several industrial firms sometimes poses some thorny problems that the top-down approach is not sufficient to solve. It sometimes even happens that a few flashes of genius have to contribute here and there, which the method had not quite entirely foreseen.²

But Descartes' Method is even more than that, for it is also a school of autonomy, as suggested in the third of the Rules for the Direction of Mind:

What we must seek about the object of our study, is not what others think of it, nor what we ourselves suspect, but what we can see clearly and with evidence, or deduce in a manner that is certain. This is the only way to get to science.

Where we can clearly see that what it is all about is not the autonomy of the subject, since Descartes advises us not to attach ourselves to what is³ already there, that may have been thought by others, nor "to what we ourselves suspect", but the autonomy of *the subject's movement*, which is something quite different. Moreover, the same occurs in the famous "I think, therefore I am" which affirms nothing on the thinking subject itself, but *only that the movement of thinking exists*. As for the nature and features of the being that thinks, nothing is really said in this sentence.

Another issue that neither my colleague nor the good Descartes seemed to me to deal with with sufficient attention or above all, with sufficient precision was the criterion to be used for stopping the decomposition of tasks. I think I remember that, in essence, this criterion comes down to "we stop breaking down when a task of the last level is - or seems - intuitively clear⁴." In other words, when it appears as obvious. Very well, but what means to be obvious? How does that become manifest? The question is generally eluded on the pretext that, since it is obvious, there would be nothing to say about it, which is not so far from some kind of argumentation about the dormitive virtue of

2 A critical subsystem that was to be installed on a ship but of which had not been noticed that it did not pass through the corridors, created one day an unexpected and very embarrassing situation. While all were in despair, a sudden fulguration suggested cutting the hull, bringing the system through the opening thus created and then re-welding the hull. Elementary my dear Watson ... So was it done. This practice, although based on common sense as well as on genius, was however not ever not recorded in the catalog of recommended industrial procedures.

3 What **is lies** said someone whose name I long have forgotten

4 "The whole method consists in the order and arrangement of objects upon which the mind must turn its efforts to arrive at some truths. In order to follow it, we must gradually reduce the embarrassed and obscure propositions to simpler ones, and then proceed from the intuition of the latter to arrive at the same degrees by the knowledge of others". Descartes - **Rules for the direction of the spirit - Rule fifth.**

opium⁵For my part, I fear that the answer is: obviousness becomes manifests when a sudden intimate⁶ movement of the mind occurs in us that designates it to us as such. So that, on the basis of some aspects of some of the Rules for the Direction of the Spirit (circa . 1628-1629), I suspect that ultimately the effectiveness of Descartes' Method when put into practice, is actually rooted in intuitions⁷ or hopes of future intuitions⁸. And in the event that such an intellectual event would not take place properly, Descartes advises us to decompose further the task which would prove recalcitrant to become spontaneously obvious. Thus, the core of the Method's operation does not reside at all in the Method itself, but in elementary intuitions, in all the small atomic and intimate proofs and convictions which weave together and establish a composite truth. May one of these little intimate convictions happen to fail and everything collapses.

It is undoubted that Descartes actually *thought* when creating his Method. But the central question remains: But ... do we actually *think* when implementing it? After all, the simplest computer program also runs according to a method, which is close to the Method itself. Nevertheless, a computer program is not granted the capacity to think. Where is thought located then? If we try to identify what in the Method of the Discourse really belongs to the work of thought, it seems to me that this is located in two main aspects. On the one hand, in the series of choices through which the decomposition will be carried out and, on the other hand, at the end of the conveyor belt of the Method, in small but easy and obvious tasks, the obviousness of which relies either on an intimate conviction, or either on a know-how, that is to say, in the difficult but frequent cases where the devil nests in the details, on a certain faculty of human improvisation. As regards the work of thought which leads to decomposition, the seventh of the Rules for the direction of the mind is quite clear; it is a simple enumeration:

- 5 Why does opium cause men to sleep ? Because opium has a dormitive virtue !
- 6 It is indeed an intimate movement of the mind, a movement of conviction which is not so far from mysticism. If one fails to grasp the necessity of respect for this intimacy, one falls into the following discourse which is only too frequently encountered in the mathematical classes: "I did not understand ..." says one. "What do you mean ? it's obvious!" says the other, proving that he did not understand mathematics, nor pedagogy nor his pupil. The Prophet in this case is finer who says that constraint in matters of religion does not fit.
- 7 "Finally, we must make use of all the resources of intelligence, imagination, senses, and memory, in order to have a distinct intuition of simple propositions, in order to compare suitably what we seek with what we know, and to find the things which are to be thus compared with each other; In a word, one must not neglect any of the means of which man is provided". Descartes - **Rules for the direction of the spirit - Rule twelfth.**
- 8 After having seen some simple propositions by means of intuition, if we conclude about some other, it is not unnecessary to follow them without interrupting for a moment the movement of thought, to think about their mutual relations, and to distinctly conceive at the same time as many as possible; It is the means of giving our science more certainty, and our mind more extent. Descartes - **Rules for the direction of the spirit - Rule eleventh.**

In order to complete science, it is necessary that thought should traverse, with an uninterrupted and continuous movement, all the objects which belong to the object which it wishes to attain, and then sum it up in a methodical and sufficient enumeration.

In what way is the enumeration precisely methodical and avoids the unexpected irruption of Jacques Prévert's raccoons⁹, is hardly specified. By what means can we ensure that it is sufficient, this is not really said either. The thirteenth rule sounds alike :

When we understand a question perfectly, we must clean it from any superfluous conception, reduce it to the simplest, subdivide it as much as possible by means of enumeration.

By what means a question that one understands perfectly may be cleaned "of any superfluous conception"? The Method remains silent about it, except that again enumeration is invoked to provide for it, which poses the same questions as those raised in connection with the seventh rule. So that, all the art of the Method consists in basically abandoning oneself to the movement of a casual enumeration and to then use common sense or some other "wet finger in the wind" kind of measurement instrument - other names of habit and of routine - to sort out the superfluous black raccoons from the relevant white raccoons¹⁰.

Descartes is rightly proud to have devised a method that will allow us to find a solution to any problem we may wish to raise, but it seems to me that he did not really ask himself whether it was the best and optimal one. Descartes, will you say, was a philosopher and not an industrialist. That's precisely what I'm not so sure about ...

Industrial surrealism

- 9 Jacques Prévert is well known in France for a poem made of enumeration of enumerations, each of the enumeration ending with "and a raccoons" or "and yet another racoon", etc. All these raccoons have of course no relation with the enumeration above... This poem gave birth to the expression "une énumération à la Prévert".
- 10 We may also think of a surrealist game involving an "unregulated" implementation of Descartes Method, a game that would disdain any sort of racism and that would not rule out any raccoons, neither white ones nor black ones.

Not very long ago, a method has emerged amongst industry managers that was based on procedures and measures. What may possibly be more rational indeed than measures? As I happened to work as a propagandist of this method for earning my living, I sometimes explained it in the following way: "Let's assume that you want to go to the moon ... You comfortably sit on your favorite seat and you measure the distance between this seat and the moon. And then you wait for a while ... After which, you measure again your distance to the Moon, etc. "

"For the moment, please note that you have not been asked to think and that a computer equipped with the sensors and the required software can carry out measurements as well as you, or rather better, I mean *without thinking* . Do not forget that this method is recommended - or even imposed - by high-ranking managers whose thought flies a little higher than yours, although sometimes it also shows some weaknesses in details. For example, some procedures may not be fully defined, or even may not be really applicable, or they may not even be listed in the procedures dictionary, as for instance may happen in areas such as Research & Development where unfortunately there happens to be things to be researched and developed ".

"Yet, for the time being your measurements campaigns, although reiterated, have not brought to light the slightest reduction of your distance to the final objective, namely the Moon. The dots that you or your computer have plotted on your progression curve are similar to those of a flat electroencephalogram. Besides as we are speaking about the Moon¹¹, it may be necessary to move a little bit your ass from the comfortable seat the use of which I recommended because despite its elegant wheels, it has not moved much".

"The trouble is that the precise way we should move our asses in order to achieve the goal does not seem to be described in the recipe. So we have to think a little bit and, for example, draw up *a plan*. Now, how can we achieve that ? Well, it's very simple ... The method if we dig a bit deeper into it gives us a solution that shall work for sure: we will meet and do some *brainstorming* sessions or else we may use a fairly similar commercial method called *Metaplan* ".

So since we do intend not to waste our firm's money, what is *brainstorming*? With some help from Wikipedia we find that it is a method invented in 1939 by Alex Osborn.

Two basic principles define brainstorming: the suspension of judgment and the widest possible research. These two basic principles are reflected in four rules:

- Do not criticize,
- Be freewheeling,

11 Moon is an equivalent of ass in France, in some light argot way of speaking..

- "Hitchhike" on the expressed ideas ,
- And try to get as many ideas as possible without imposing your own ideas

Thus, absurd and fanciful suggestions are admitted during the production and mutual stimulation phase. Indeed, the participants with a certain reserve can then be encouraged to express themselves, through the dynamics of the formula and the interventions of the facilitator.

The absence of criticism, the suggestion of ideas without any realistic basis, and rhythm, are vital elements in the success of the process.

As I am now retired and hence free of thought as well as of speech, I remember that in the years 1920-1925 a group of young people who called themselves Surrealists had defined and intensively implemented a set of methods quite similar to brainstorming, although they often aimed to more artistic than properly industrial goals. And I remember that these young people had drawn certain consequences as regards the art of living - as to theirs at least.

Hence in terms of inventions, Osborn happened to be a bit late. But his initial brainstorming method was soon rationalized to meet industry needs, most particularly those of the commercial advertising industry, which led to the invention of *Creative Problem Solving*:

The main stages of Creative Problem Solving which are the clarification of the objective, the search for solutions and preparation for action, originate from the mixing of two processes, described on the one hand by Henri Poincaré (scientific creative process: impregnation, incubation, illumination and experimentation) and by Graham Wallas and Richard Smith on the other hand (artistic creative process: preparation, incubation, intimation, illumination, verification). 8 stages (according to Olwen Wolfe's model, validated by Sid Parnes). The eight main steps are: 1 - Needs, 2 - Data, 3 - Objectives, 4 - Ideas, 5 - Criteria, 6 - Solutions, 7 - Membership, 8 - Action Plan.

One will suspect that the original *brainstorming* is used during each of these eight stages and that the *Creative Problem Solving* is not much more than an enumerated and iterated implementation of the original *brainstorming* in the various dimensions rationally required by the *Creative Problem Solving* method. I would venture to say that *Brainstorming* and *Creative Problem Solving* are two different modes of an industrial implementation of surrealist methods.

We note in passing the important contribution of the famous mathematician Henri Poincaré whose method in 4 points above significantly differs from Descartes' Method and seems to make, as Surrealism does, *a fairly large use of the work of the unconscious*. From this to thinking that the *creative* mathematical activity *is not fundamentally rational*, there is only one step, which I invite the reader to make, and on which I will come back anyway a little further on.

As the implementation of the brainstorming method led us to establish a plan, we may now hope to get a little closer to the Moon. But nothing being more sneaky than the obvious, what does planning actually mean ?

Planning implies a hierarchically organized set of actions in which different kinds of decisions are ordered in a functional way in order to think the future and to control it.

In a clearer language and hence with a little less of "managerial-style" of speaking¹², planning consists in implementing the Method described in Descartes' Discourse, in other terms, to proceed to the implementation of an unbridled enumeration followed by a hunt for irrelevant (black) raccoons ... *But* while taking into account the hazards and possible risks encountered during the implementation of the results of the Method. Which is wise, and we must reproach Descartes for not having thought of it. Fortunately Blaise Pascal came not long after to cover this ugly flaw.

And so again, the work to be carried out is broken down and the risks and uncertainties identified at each step by an intense use of brainstorming. And if this decomposition is not enough - which is to be suspected as to what is to reach the Moon - we will establish sub-plans, then sub-sub-plans for the actions whose obviousness does not appear strongly enough. How will these sub-plans and sub-sub-plans be established ? How will risks and uncertainties be identified ? By an iterative and repeated use of Brainstorming or even of Creative Problem Solving if necessary. In other words, by means of a rational and moderate industrial use of the inaugural methods of Surrealism. Or perhaps more precisely in a *programmed* implementation of surrealist methods. But again, where are work and thought located ? They are in the establishment of the plan, in other words in *brainstorming*, because in terms of monitoring the execution of the plan, a computer with adequate measuring sensors and suitable software will suffice.

We can then come back - yet on an industrial ground now - to the question I raised about Descartes' Method, that of knowing where and how the planning process stops. It stops at the level where no conscious brainstorming is any longer needed, that is to say at the level of the defined and listed procedures for the implementation of which no

12 The French usually uses the word "technocratic" instead of "managerial"... Unlike most people who use the word "technocratic", I have devoted a significant part of my life to technique, so I confess that I fail to understand how the "technocratic" ways of thinking and acting may be of any sort of technical nature . Yet, having essentially practiced at relatively low hierarchical levels, I understand very well how "techno-**cratic** is indeed representative of "**cratic**". So that, in the hope of making the French language somewhat more reasonably fit for the exercise of intelligence, I propose that the word "technocratic" should henceforth designate *the power exercised over the technique* and not the power exerted by the technique, which I fear does not exist.

more thinking is required. At least theoretically ... For if the implementation of well-defined procedures sufficed to face the thorns of the Real, it would obviously be entrusted to machines, largely driven by computer software run by computers.

The details of the implementation of the plan are therefore entrusted to the *executants*, who will actually have to deal with the "simple" and "obvious" tasks assigned to them, which means to use their personal or collective, conscious or unconscious brainstorming once more. But more and better they will feed the productivity improvements of the company with their own creativity (hence surrealist) via the *Kaizen* *japanese* method and the famous cycle : Plan, Do, Check, Act ...

This Japanese approach is based on small improvements made on a daily basis, constantly. It is a gradual and soft approach that is opposed to the more Western concept of brutal reform such as "we throw everything away and start over", or innovation, which is often the result of a reengineering process. On the other hand, the kaizen method tends to encourage every worker to think about his work and to suggest improvements. So, unlike innovation, Kaizen does not require much financial investment, but a strong motivation of all employees. Consequently, more than a management technique, Kaizen is a philosophy, a mentality to be deployed at all levels in the company. The proper implementation of this principle includes:

- *A reorientation of the company's culture;*
- *The implementation of tools and concepts such as the Deming wheel , Total Quality Management tools, an effective suggestion system and group work;*
- *Standardization of processes;*
- *A motivation program (reward system, staff satisfaction);*
- *Active involvement of management in the deployment of the policy;*
- *An accompaniment to change, when the transition to Kaizen represents a radical change for the company.*

In summary, from one level of the hierarchy to the next, from planners to executants, the *Power does not create anything, it just sips the workers' creativity*¹³

Encounters

Despite all the bad thoughts that everyone secretly feeds about this, and despite the surrealist bolts and nuts on which everything is working, all this does not work that badly. Cars run, planes fly and ships sail. In short, once a goal has been established, Descartes' Method of industrial generation of (white) raccoons allows reasonably often

to reach it. Yet there remains a blind spot, a vanishing line: how is the goal to be achieved determined? For bankers, financiers and thieves, the answer is apparently simple: money is the goal to be achieved and everything else flows from it. But while thieves do not need their victims' acceptance, bankers and financiers have to obtain it and to suggest that the transactions are - win-win - balanced . So customers must want something ... *But what must they want?*

"What should I want?" Asks Rene Girard's Salome to his mother Herodiade. " Ask John the Baptist's head" her mother replies, who for some reason wants the death of the John the Baptist whose speeches create problems in her life. And Salome, who most probably has no idea who this John the Baptist is, asks "John the Baptist's head, *on a tray!*". René Girard notes that Salome's idea is an artist's idea. But he deduces that desire is mimetic and that Salomé has just duplicated her mother's desire since she herself had no particular desire. And he concludes that the mechanics of desire is ultimately nothing else than mimicry¹⁴. Yet Salomé, who does not care the slightest about John the Baptist, either dead or alive and thus does not care either about what her mother wants, has a desire of her own, which is that one offers her a head *on a tray*.

And how did this desire come to her ? Well, summoned to the point of wanting something, she appealed to the resources of surrealist automatism so that her unconscious provided a solution. What happened next is an encounter, that of Salome's new artistic desire with that of the old and recurring desire of Herodiade, a rather utilitarian one. Art is the movement of a desire that is elaborating itself. How would rational thought have responded to Salome's need? It would not have answered at all, because for rational thought, such a question does not exist.

Cartesian thinking is actually a thought of achievement, a thought of implementation. A thought of the organization of work¹⁵. The Method marks the moment when industrial thinking breaks into the field of culture. Descartes is not the only symptom. Galileo and Spinoza and many others are thinkers and scientists of course, but they are also craftsmen. Galileo introduces measurement in physics. This is a craftsman's invention. Would you imagine that a professor in the universities of the time could have thought of measuring anything?

Descartes' Method is a thought of the division of labor, a thought of the organization of execution. Give it a goal, it will probably reach it. But although it relies on a certain *autonomy* of the movement of thought, it is fundamentally heteronomous. It is not meant

14 This presupposes that the first desire, that which has been mimicked, is born by spontaneous generation. Not anyone who wants can be Louis Pasteur ...

15As my friend Karl Jan Bogartte so clearly expressed in an e-mail: "the logical mind, typically begins with a linear fashion, in sequence, but a non-linear approach is random, Usually, beginning and ending anywhere ".

to have desires, neither to will nor to decide. There is nothing aristocratic in it . It is not a noble's thought. It must be fed, provided with objectives and goals. It excels at providing answers, but does not seem to be able to raise questions. Yet it is much more difficult to raise a good question than to find the answers. The practitioners of the computer language Prolog, dedicated to Artificial Intelligence (as understood at that time¹⁶) a language that looked somewhat oracular, used to make jokes about it : "If Prolog is the answer, then what is the question?"

Similarly, industrial surrealism is a thought of execution. It bends, and exploits the autonomous movement of thought in the directions required by the external will of firm managers. Abandoned to its own movement, it will enable to develop and realize in a better and better way, and this more and more economically, and more and more rapidly *increasingly obsolete products*. That is obviously what it does everywhere. But it does not know how to answer the question "What to do?" or "What to build?" or "What to sell?". It is incapable of creating any radically new product and a firm whose catalog is aging and getting obsolete is doomed to disappear. Nothing is more pitiful than an industry that has nothing to sell. In order to create new products, what is required is something very different from rational thought. It requires having the right idea at the right time, in other words, *genius*.

Genius can be found, at least some. I've met a few designers, software architects, or systems architects capable of creating whole products or systems that nobody had ever dreamed of before, or to make existing products in a radically new way. I have observed that they all had specific character features which rendered them, in the unanimous opinion of their hierarchy, almost *ungovernable*. Which the hierarchy tolerated fairly well, obscurely feeling that its own existence depended heavily on their finds. These designers, these architects are not Cartesian minds. *They are not at all the kind of fairy-tale characters able to solve problems, answer questions or find solutions*. Rather, they belong to the kind of "specialists" who excel at *solving problems that have never been stated* or at *answering questions that no one has ever raised before*¹⁷. They are not strictly speaking rational. *And they know it*. I once knew one of them who escaped from the company which employed him as soon as attempts were made to impose on him the methods of industrial surrealism. He immediately came to the service of the

¹⁶"algorithmic" Artificial Intelligence that is, different from artificial (neo-) connectionist intelligence on which deep learning is based

¹⁷In what way they are strictly speaking very learned in Pataphysics, which is, as we know, the science of imaginary solutions.

competing company and I recently saw that he had become the Chief Executive Officer. In Europe, this would be an exceptional case: this kind of individual, one usually gets rid of them as soon as they have fulfilled their task. Yet it is necessary to imagine that without this type of men or teams, industry - and many other things - would not exist at all. These people are *technicians*, and hence they are *men of the art*. They are not rational, they haunt regions of technology that from the outside one would rather tend to imagine as belonging to the domain of magic. This is not the case, however, and it is not magic, but only the marvelous: *they are merely the human thought at work*.

It must also be considered that genius is largely a matter of chance. To be a genius, that is, to have the right idea at the right time, you have to be in the right place. Hence, one way or another, you have to be a *professional*. To point out that he was neither a mason nor a baker does not mean diminishing in any way Albert Einstein's genius. His work at the patent office in Berne may be regarded as obscure, but at that time the still very fresh German Empire, stubbornly insisted on getting the trains to arrive right on time. This in the *Prussian* fashion, that is to say, *absolutely on time*. One can guess that Einstein saw numerous patent proposals on the problem of synchronization of clocks, which is certainly not unconnected with the ideas of Restricted Relativity. Moreover, the first works of popularization of Restricted Relativity in the early 1900s showed many examples of train movements and people moving in trains.

Of course, it is not enough to be in the proper job at the proper time. There is a coincidence that, among all those who are in the proper profession at the proper moment, only a few will have the new idea which the others will not have. Claude Shannon was not the only telecommunications engineer in the world when he invented the Theory of Information¹⁸. The path that leads to this theory is not very steep and it could have come to the minds of many others. Let a transmitter, a receiver and a channel for transmitting signals from one to the other ... The problem that arises is to transmit as many messages as possible through the channel. As Nature did not invent the alphabet without the help of men, it is necessary to encode the messages using some sort of alphabet and then transmit the encoded messages as signals through the channel in the most effective manner. Now, unlike the NSA and many other public or private organizations, a telecommunications engineer is not at all interested in the semantic content of the transmitted messages, and Shannon's theory is not concerned with it either. On the other hand, optimizing the signals for transmitting the characters of the alphabet is a problem for a telecommunications engineer. Shannon's idea is to observe that it is advantageous to code the most frequent characters of the alphabet with the simplest signals which will occupy the least (long) possible the communication channel and to reserve the most complex signals to the less frequent characters. It is

therefore natural¹⁹ to consider that the least frequent signals contain more information than the most frequent signals. This means that the larger the (relative) surprise, the greater the amount of information associated with it. Shannon 's true stroke of genius resides in my opinion in having elaborated out of the technical situation to which he was confronted, a quantifiable notion, purified of any other semantics than that related to the problem posed. To do this, we have to abstract. It seems that he alone did it.

But the random aspect of genius is not reduced to that. It is necessary that the idea, the good idea, the beautiful idea, happens to you at a time when it is acceptable by the rest of humans. It is not to be injurious to Leonardo da Vinci's genius to observe that most of his inventions did not arrive at the right moment.

This is one aspect of things which very close to the much more general situation of *Darwinian preadaptations*.

It must be acknowledged that Darwin had several brilliant ideas. Among these is what is now called the Darwinian preadaptations. Darwin pointed out that a given organ - let us say the heart - could have causal characteristics independent of its function and devoid of any selective influence in its normal environment. One of these causal characteristics could nevertheless provide a selective advantage in a different environment. [...]
Darwinian preadaptations are plethoric within the biological evolution. When one of them occurs, it usually generates a new functionality within the biosphere - and thus in the universe. A commonly cited example to illustrate this: is the case of the swim bladders of fishes²⁰ ...

The swim bladder, as its name indicates, is a device for regulating the floating of fishes. It is derived from a kind of primitive lung, itself derived from a diverticulum of the digestive tract. In other words, the primitive lung of the fish, which was initially only a highly irrigated organ providing a respiratory function rather complementary to that much more fundamental of the gills, was finally found to provide the much more critical function by means of which a fish can move freely and effortlessly into the water without permanently fighting for not sinking to the bottom or rising to the surface²¹.

Thus, in the case of Darwinian preadaptations, the function does not create the organ, nor does the organ create the function. What creates the function is the encounter between the solution to a problem that did not arise on the one hand and, on the other

19 It is "natural" but only provided that we put ourselves in some way "in the place" of the channel.

20 **Réinventer le sacré** - Stuart Kauffman - Editions Dervy - P194

21 Sharks and some other fish are not able to do that. They have no swim bladders. Hence they must make efforts not to sink.

hand, an environment in which the problem that is solved reaches a clear expression mainly through the irruption of its solution. In other words, what happens in Darwinian preadaptations, as in the case of an idea of genius, is something more than luck. By inventing a measurable notion of information, Shannon does much more than have a good idea at the right time, he changes the course of the thought of his time, resulting among other evolutions in a new interpretation of entropy²² in classical physics and some modifications of ideas in quantum physics.

What is fundamental in thought as well as in Darwinian preadaptation is their nature of *encounter*. What one cannot fail to remind of of Pierre Reverdy's famous remark:

The image is a pure creation of the mind. It can not arise from a comparison but from the link created between two more or less distant realities. The more distant and righter the relations of the two close realities, the stronger the image - the more emotional power and poetic reality.

The swim bladder was not born from a comparison with the lung. Nor did Shannon's Theory of Information arise from a comparison with the contents of newspapers. What really happens in creative thought as in Darwinian preadaptation is an *incomparable encounter*.

Irruption of the Method

But let us go back to Descartes and to rational thinking. Let's be clear : I do not intend to throw the baby with the bath water. I do not intend either to throw stones at René Descartes, nor even to throw other more numerous stones to his much less talented followers of the industrial world. Let us rather say that in my own way I am a man of order who likes to distribute glory to each according to the rank due to him. That there was thought in Descartes' invention of the Method, is certain. A kind of genius, for sure. And we must salute that. It is more doubtful that there is a real need for genius in its implementation. A method, does not think. *Man is what stands beyond the algorithm.*

Why does the *Discours de la Méthode* (1635) or its prototype, *Règles pour la direction de l'esprit* (1628-1629) appear so late? After all, there is essentially not more in it than the division of labor which can be symbolized by the immense building site of the Pyramids and hence appeared long before 1650, the year in which Descartes died.

I am not an historian or a scholar I good enough to judge, but I shall venture to expose here a few suspicions.

The first French royal factories were created in the years 1663 to 1764, more than 10 years after Descartes' death. However, with regard to the *Manufacture de la Savonnerie*, things began a somewhat earlier:

The name of the first carpet royal factory founded in France, the Savonnerie derives from an old soap factory located in Chaillot, roughly at the present location of the Palais de Tokyo. This soap factory was transformed into an orphanage by Marie de Medicis. The cheap labor procured by the orphans attracted two weavers, Pierre Dupont (1560-1640) and Simon Lourdet (circa 1590-1667), who transferred to the site in 1631 the manufacture that they had founded in 1627 or 1628 by order of Louis XIII.

The same applies to the *Manufacture des Gobelins*, which only became royal in 1663, but which is in fact the continuation of a private factory supported by Henri IV:

In order to free the kingdom of the important expenses which were due to the importation of foreign tapestries, and to avoid this money to leave the kingdom, King Henry IV decided, in April, 1601, to install two dyers and Flemish upholsterers, Marc de Comans and François de la Planche in a great house. the first was from Antwerp and the second from Audenarde, and they had been associated since January 29, 1601 to make tapestries in the Flemish fashion. In January 1607 Henry IV granted them patent letters in which he indicated that he had the two Flemish tapestry-makers come to install tapestry factories in Paris and other towns in the kingdom. The King wishes and orders that Marc de Comans and Francis de la Planche be considered as nobles, commensals and servants of the royal house and that they enjoy the prerogatives, exemptions and immunities attached to these qualities.

[...]

On behalf of Louis XIV, improving Henry IV's adopted plan, Colbert prompted shortly before 1660 the Dutchman Jean Glucq to import into France a new process of scarlet dye called "à la hollandaise". In 1684 Jean Glucq finally settled in one of the houses of the former Folie Gobelins, which he bought and embellished after obtaining the French nationality

The work done in the manufactures was essentially manual. Nothing that at first sight seems to have any relations with a fine division of labor or with the work chain as they were developed and implemented during the "Industrial Revolution". Except that this is not the case. For, as *Christophe de Voogt*²³ notes in *The Civilization of the "Golden Age" in the Netherlands*²⁴ :

²³[Christophe de Voogt](#) - Maître de conférence à l'Institut d'études politiques de Paris, ancien directeur de la Maison Descartes (Institut français des Pays-Bas)

In the Middle Ages Holland, that is to say, the present-day province of Holland, from Rotterdam to Amsterdam, possessed large woolen weavings, which worked for exportation. This industry was settled in the towns; The center was in Leyden, where, since the fourteenth century, a drapery flourished, which acquired great renown in the fifteenth and sixteenth centuries.

The drapery industry is very complicated; The raw material is subjected to various partial operations in successive phases. In other words, the drapery industry demands a lot of partial producers who partly re-work each other's work results ; these partial producers are only found in densely populated cities. Moreover, Holland was, above all, a country of cities that had a predominant influence on the entire country.

In other words, the division of labor had long been well advanced in the Dutch drapery-making industry at the time when Descartes was staying in Holland. But Dutch methods and products also attracted the almost general admiration of certain important ministers of the kings of France, since :

Richelieu already emphasized the "Dutch miracle" and clearly discerned the cause of it: "The opulence of the Dutch, who, strictly speaking, are but a handful of people, reduced to a corner of the earth, where there are only water and meadows, is an example and a proof of the utility of commerce, which is not disputed."

In other words, since 1601 at least the kingdom of France imports Dutch technologies. René Descartes, a Frenchman born in 1596, and a contemporary of Cardinal de Richelieu, admirer of the Dutch, stayed in Holland in 1618-1619, during which time he became a friend of the Dutch mathematician, physicist, physician and philosopher *Isaac Beeckman* who studied Philosophy and linguistics in Leiden (hence, in the main city of the drapery industry in Holland), and who happened to be the son and brother of artisans and / or manufacturers of roof tiles and candles, and was supposed to take the lead after his father's retirement. *Isaac Beeckman* is not only a theoretician but also a thinker concerned with techniques and applications. And he founded in 1626 in Rotterdam a group of exchanges on technical subjects, *the Collegium mechanicum*. Besides, in 1619 after his meeting with Descartes on November 10, 1618, Beeckman still was working as a roof decker in parallel with his scientific work.

The friendship between Descartes and Beeckman has nothing anecdotal about the later evolution of thought. It clearly begins as a master-student relationship, to the point that Descartes later wrote to Beeckman:

24La civilisation du "Siècle d'or" aux Pays-Bas.

https://www.clio.fr/BIBLIOTHEQUE/la_civilisation_du_siecle_dor_aux_pays_bas.asp

On peut voir aussi : La naissance de l'industrie rurale dans les Pays-Bas aux XVIIe et XVIIIe siècles

[article] sem-linkZ.-W. Sneller, Annales d'histoire économique et sociale Année 1929 Volume 1 Numéro 2 pp. 193-202

"I was sleeping, and you woke me up. You alone have shaken my laziness, and you have recalled my erudition to my memory, which had almost escaped from it. "

Then their intellectual friendship developed, since they both proposed to write *a treatise on mechanics*. That under these conditions the illumination of Descartes on November 10, 1619 in Neubourg following three dreams of high intensity may have nothing to do with Isaac Beeckman and with the Dutch methods and technologies is not reasonable.

But there is more and better ... In 1691, Adrien Baillet first biographer of Descartes writes:

"The search which he wished to make of these means, threw his mind into violent agitations, which increased more and more by a continual restraint in which he held its mind, without suffering either the promenades or the companies to divert him. He fatigued himself in such a way that the fire took in his brain, and that he fell into a kind of enthusiasm, which disposed his mind already so dejected in such a way, that it enabled him to receive the impressions of dreams, and of visions.

He tells us that the tenth of November of the year 1619, having gone to bed full of enthusiasm, and occupied with the thought of having found the foundations of an admirable science that day, he had three consecutive dreams in one night, that he imagined he could only have come from above. "

Is it not astonishing to see the most celebrated promoters of a methodical use of reason assert that his discovery is due to impressions stemming from dreams and visions?

Mathematics

The essence of mathematics is freedom - Georg Cantor

"Mathematics are simple", used to say one of my friends, "since one only progresses in this science by moving from one obviousness to the next". But what is obviousness except something like a fulgurance. Do you think that I am exaggerating? Maybe, but then I am not the only one. I remember a book by *Martin Gardner* entitled "Haha or the flash of mathematical understanding". In which way may the heavy and methodical so-called rational thinking account for the lightnings of the mind?

Let us pass further ... Demonstrations are central in mathematics. Not only because they constitute the proof of what is proposed, but also (especially) because they constitute the *narratives* by which mathematical ideas are propagated. All demonstration is first of all the history of the intellectual adventure of its author²⁵, and then a theater which aims to convince the reader - beginning with the first (re-) reader that is the author himself ²⁶ - and beyond the reader, the whole world, for *there is no human truth except based on the consensus of the whole species*.

The logical elements that articulate and support the progression of the demonstration, the "and", the "or", the "no", the "then ...", the "so ...", the "for all ... such as ... ", the "there exists ... at least one ... " are a punctuation of thinking, but they are not thought itself. Look... There are software programs that demonstrate theorems, and yet, no one infers from so little that these software programs *think*.

It is remarkable, however, that the demonstration which is perhaps the most eminently *social* act of the mathematician can also be carried out by means of machines. While I am not able to explain it clearly, it seems to me that this says something strange about the nature of social relationships - or about the nature of language at the very least. Is all the technique already lurking under language? Was language sneakily lurking within technique already? Both are in fact implicitly rooted in the social as suggested somewhere by Piaget who notes that current mathematical operations have their counterpart in social relations in the course of collective work or play.

It is surprising too that that mathematical thoughts that are often deeply rooted in analogy, such as that of Henri Lebesgue, inventing the theory of the integral which bears his name while daydreaming about the tiles of a roof, can be expressed by means of the logic of demonstrations that seems, after all, to be merely a syntax game.

But what happens in the holes and hollows of syntax? For a proof to be valid, it is nevertheless necessary that the logical operators connect *something*. And the things connected by means of the logical connectors must be *true*. But what does mean true, except marked with the seal of the obviousness ? That is to say, stemming from all sorts of small events of the mind, atomic spiritual events in a way, that were encountered in the demonstration but which, while being the zero degree of fulgurance, are nevertheless of the same nature as it. All evidence, no matter how small, is based on *conviction*. In other words, on a *conversion* of the mind.

25 It is so true that very often the first proof provided by the author of a theorem is not necessarily either the definitive proof or the simplest.

26 "I see it but I do not believe it," Cantor said when discovering that there are as many points in a straight line as in all space.

And so, a demonstration, is either a mental event for the reader, or it is no proof at all. The proof in its intimate active moment says: "**That is it!**". But who will dare say what this "**that** " and this "**it** " are made of ? *At the heart of the evidence, the unspeakable.* Nevertheless, I will not call more here for mysticism than mysticism usually calls for mathematics. No less either. *It is all about the human mind.* Mystic or not.

Besides, even computerized, where lies the proof? Is it in the machine that possibly establishes it? That is doubtful. For the machine knows nothing of what it does. The ultimate proof lies *in the conviction of mathematicians* who re-read and validate the proof possibly established by the execution of a software or, more frequently by the work of a colleague. *There is no evidence for a computer.*

Mathematics, *insofar as they are creative*, are not rational. And it is good and even legitimate that they are not. Beyond the strange method of scientific creation enunciated by Poincaré, that I quoted above, it will be remembered that Poincaré, once seized with a sudden idea during a reception, used the back of his neighbor's tux to write some formulas with a piece of chalk he drew from his pocket. Is this a reasonable behavior ? Is this an attitude which one would agree to call rational ? Or rather that of a poet who would have decided not to lose anything that could be suggested to him (mathematically speaking) by that shadowy mouth that spoke to Hugo, to Breton and many others ?

Roger Godement long ago in his beautiful *Course of Algebra* noted that if we could build a machine to establish theorems, that is to say all theorems possibly created from a given set of axioms, it would then accumulate theorems and their proofs in the manner of Brownian motion. In other words, it would construct a library of theorems and proofs analogous to the Library of Babel by *Jorge Luis Borgès*. A maze of truths with no geography at all, which would then have to be mapped in order to identify the main roads, ridge lines and crossroads, and within which it would be advisable to separate the trivial and uninteresting truths from the deep and fundamental ones.

Imagination in mice

Precisely, it is not insignificant to recall that the world - or at least the approach of the world by living beings - is an object of geographical, or at least of geometrical ²⁷, nature.

27 Is it possible to deduce the shape of the universe without stepping outside of it? Henri Poincaré thought so. Similar to how the Greeks were able to discern the spherical nature of the earth (and even its rough diameter) using mathematics, he proposed that we should be able to make conclusions about our universe.

The following quotations are taken from one of the radio programs of the series *Sur les épaules de Darwin* by Jean-Claude Ameisen and devoted to the 2014 Nobel Prize for Physiology or Medicine which rewarded the works of John O Keefe, May-Britt Moser and of her husband Edward Moser on spatial localization in mice.

The discoveries of John O'Keefe and May-Britt and Edward Moser revealed two essential and complementary components of learning and memorizing of space. A memory of the exact places where we were²⁸, a form of autobiographical memory: it is at this precise place where we were and we remember the journey we made; and a memory of the topography of the environment²⁹ in which we traveled, inscribed on a grid plan, a grid of hexagons, a coordinate system that allows us to deduce the distances and the borders all around the place we are. A souvenir of the map of places and a precise souvenir of our journey through these places.

In the continuation of the radio program, Jean-Claude Ameisen completes the results obtained by John O Keefe, May-Britt Moser and Edward Moser by some other results from adjacent or more recent studies.

One of the studies cited concerns the process of memorizing the places traveled:

*Studies in mice who are on a path indicate that each time they take a short break or stop to eat, the film of the path they have just made, the succession of the activation of the different location cells passes several times in accelerated pace in their hippocampus. The path to the location and the path to get back from it . The path to the location, is the film of the way they have traveled. The path back is the film of the path that they would have to take to come back if they had to go back in the opposite direction to return to the starting point, if they had to run away ...
Later, during their sleep, the film of these successions of maps - but only the path towards this location - begins, as they sleep, to fit into their lasting memory, into their long term memory. It shall repeat again and again a greater number of times, , moving into their lasting memory, in their long-term memory, partly migrating to different regions of the surface of the brain.*

It seems, then, that the continuity between nocturnal dreams and diurnal daydreams, as described by Breton in *Les Vases Communicants*, can now be seen objectively and is hence scientifically established, in this case in mice. It is therefore a process which is in no way restricted to the human, poetic or artistic domain, but to a mode of functioning of the brain that is at least common to mammals.

28 Each of the memories of a place is recorded in a particular configuration of activation of location cells.

29 The topography of the places is recorded by configurations of the grid cells realizing a hexagonal tiling of the space traveled by the mice

But there is more, memory is also the raw material used by the brain of the mice for the elaboration of anticipations ...

In 2011 a study by G. Dragoi G, and S. Tonegawa of the Department of Brain and Cognitive Science at MIT in Boston is published in Nature. S. Tonegawa after receiving the Nobel Prize for Physiology and Medicine in 1987 for his work in immunology engaged in neuroscience research to explore the mysteries of memory.

The study involved mice and revealed a strange relationship between memory and anticipation of the future. Mice perform a route along an artificial trail that has particular topographic components. When the mice arrive at the end of the first part of the route where the researchers put food, they stop, feed, rest or fall asleep. And during their siesta, or during their sleep, the succession of paths they have just traveled is projected as a film repeatedly in their hippocampus, beginning to fit into their lasting memory.

But this study also identified another surprising and hitherto unknown phenomenon. When the first part of the trail runs through a gate that prevents the mice from seeing the rest of the trail, during their rest or during their sleep there occurs a series of apparently random variations on these trajectories. A succession of new and open trajectories appears in their hippocampus. As if during their rest and during their sleep a prefiguration of the possible topography of the invisible sequence of the journey was invented, an exploration of a still unknown imaginary geography . As if during the rest and the sleep the draft of a memorization of the future course in the unknown part of the track was prepared, a directory of possible pre-adaptations to a still unknown topography, but which could share some common characteristics with the locations that have just been traveled and which are in the process of being memorized

And two years later in spring 2013 G. Dragoi and S. Tonegawa published their explorations of this anticipation of the future in mice. The study G. Dragoi and S. Tonegawa has been published in the proceedings of the US Academy of Sciences. It indicates that in the mice placed in front of the closed door of a track that they have never seen before, during their sleep variations of activation of the location cells on the theme of old paths, are created in their hippocampus. In total, these variations lead to the emergence of about fifteen future trajectories that mice have not yet used .

In May 2013, when the study of G. Dragoi and S. Tonegawa was published, another study was published in Nature by two researchers from the neuroscience department at John Hopkins University in Baltimore, Bart Pfeiffer and David Foster.

They had analyzed the activity of location cells in the hippocampus of mice, not during their sleep, but during the moments preceding the moment when they were going in a direction either to go for food or to return to their shelter ... The mice are resting for a while, and then they will leave. And while they are resting the path that they will follow later scrolls in their hippocampus, even when the route that they will choose is new and

that they never used it. And so before embarking on a particular journey, this path is prefigured in their brain before they begin to use it.

The three studies cited above therefore agree on a crucial point which is the construction in the hippocampus of anticipations created from random recompositions of fragments of recent or older memories. In other words, mice *imagine* the journey to come, which may be more or less in accordance with the imagination they have formed from random variations derived from memorized fragments of their past experiences.

It is fascinating to see here at work the initiation phase of the Darwinian mechanism which is very improperly called "natural selection". This term has flourished so much that people are most often blinded by the term of "selection", so that only a few of them still seem to realize that in order to apply selection, something priorly has to exist that can be selected. In other words, "natural selection" would be a foolish idea if it did not refer to its unavoidable prerequisite which is *natural creation*. In the case of the fifteen new paths constructed by random variations on the basis of memorized fragments of old paths in mice, we are precisely in the presence of *natural creation* at work. Of course, only some of these invented paths - or perhaps none of them - will be sufficiently close to the future actual path and will therefore be "selected", but they shall have prepared the mice to what would come in the future³⁰.

The same process of *natural creation* is implemented in the mechanism of acquired immunity that allows our survival on a daily basis. Since cells have no eyes and since invaders (bacteria, viruses or others) do not carry flags nor uniforms to designate them as enemies, the immunity system must identify them as such and above all not confuse them with the cells of the organism themselves. In other words, before thinking of annihilating it, it is necessary to identify and mark the enemy.

Given the great diversity of the living organisms, the enemies are numerous and very diverse, so that the tags used to identify them (by chemically bonding to the molecules of their membranes) must also be extremely diverse. This challenge is met by a mechanism of *natural creation* quite comparable to that of imagination in mice. The cells of the immune system dedicated to producing the tags and markers have segments of genetic material with an enormous capacity for random mutations. This results in the creation of an enormous amount of different tags, which can bind to the membranes of intruders, past, present or future, or even to membranes of intruders that have never existed or will never exist. So that the intruder selects "its own" particular marker type.

30 According to Shroedinger *What is Life* (and neural sciences), we do not "perceive" reality but the difference between reality and our brains anticipation of reality. Which if you think a bit about it is quicker and more efficient than analysing reality each time... In other words, what we call reality is mostly a construct of our brain.

When a cell expressing a marker binds to the intruder via this marker, it begins to proliferate in order to reproduce many copies of this marker. In other words, the generation of the intruder-specific marker type is amplified by intensive reproduction of the type of immune cells expressing this marker when it has reached its goal by binding to the intruder..

"A human being is a priori able to produce nearly a thousand billion different antibodies. Millions of genes would be needed to store that much information, but the entire genome contains fewer than 25,000 genes. The multitude of antigen receptors is produced by a process called clonal selection. According to the theory of clonal selection, at birth, an animal randomly generates an immense diversity of lymphocytes, each of which expresses a single antigenic receptor from a limited number of genes. In order to generate unique antigen receptors, these genes are subjected to the recombination process V (D) J, during which each gene segment recombines with the other to form a single gene. The product of this gene thus gives an antigenic receptor or a single antibody for each lymphocyte, even before the organism is confronted with an infectious agent, and prepares the organism to recognize an almost unlimited number of different antigens."

Thus, we see that the adaptive immune system exhibits some form of imagination (chemical or biological³¹), and it does so precisely on the basis of randomness. In other words, the immune system uses the internal randomness of fragmentations and recombinations to counter the external randomness represented by the various enemies and intruders. Similarly, the imagination mechanism in mice employs the randomness of fragmentations and random recombinations of memories to anticipate external randomness possibly associated to a new path.

How not to think of Stéphane Mallarmé's poem: "Never a dice blow will abolish chance, every thought emits a dice thrust". ? How not to think of the aspects of uncontrolled enumeration implemented not only in what I have named above the methods of industrial surrealism, but also in the truly creative aspects of the Descartes' Method.

Looking back at the movement of the arts at the end of the 19th and early 20th centuries, Mallarmé's poem is very logically followed by quantities of Dadaist experiments that are precisely based on chance. Which not only highlights a certain quality of absurdity intended to respond to the monstrous absurdity of the Great War, but also reveals what the real functioning of thought owes to chance, that Mallarmé had "guessed" in the *Night of Igitur*. Surrealism comes next, which sets itself the task of studying *the real functioning of thought*, but it refers too quickly for this to the *unconscious*, then to the *Freudian unconscious* - which, as we know provides an answer to everything - without guessing what the mice teach us, namely that the

31 What else could it be at such a *micro* or rather *nano* level

unconscious and the mechanisms of the imagination themselves rely on a putting to work of randomness.

So that one can say that Dada is already essentially surrealist, that surrealism represents, certainly, a kind of awareness of what Dada does, but that despite Breton's remarks about *objective chance*, surrealism did not fully understand what Dada really said.

Nevertheless, by invoking chance, one is not very far from invoking the gods. Or at least *one* god. "The god of randomness, the only and true one" as Louis Scutenaire said. How does the brain manage to produce random or "seemingly random" variations? Is the brain a kind of random generator, as Mallarmé thought in *Igitur*, or is it a *pseudo-random* mechanism, in other terms a deterministic biological mechanism that produces a diversity of such magnitude and of such a richness that it appears to us to be random?

Besides, is monotheism a matter of course? Is the god of randomness unique? Is it legitimate to speak of chance or should we rather speak of several sorts of chance? Indeed, in mathematical theories and practices relating to probabilities, one always begins by constructing the set of possible events. A critical stage if any, because any error in the identification of this set will lead to calculations and conclusions that shall be insidiously erroneous. In other words, *in mathematics, chance is always relative to a given context.*

This point is not a detail, for it is mathematically incorrect to speak of the set of all possible events in the absolute. This would lead to the construction of the set of all the possible sets, a thing known to lead to logical contradictions that would ruin the whole of the mathematical edifice. Mathematically speaking, therefore, one is forced to speak of different sorts of randomness relating to different contexts, rather than of general and absolute chance. This raises the question of the diversity of the types of contexts where chance comes into play, of their categorization and classification and, where appropriate, of their use.

Biologically speaking, this raises the question of what types of randomness arising from what types of contexts are actually used by the processes of *natural creation*. Does life only use the fragmentation-recombination process of the genetic material used in adaptive immunity, or does it use mechanisms of different natures? From the point of view of thought, what types of randomness are involved in the "making" of the imagination? If, moreover, one looks at the quality and quantity of the fragments of memories recombined by the imaginative function of the brain, the imagination may be probably be richer and more powerful if it is elaborated from richer and more varied memories, and recombined in a more "random" way. If this were the case, then the

study and classification of various sources of chance could be critical to the future evolution of thought, whether it be natural thought or synthetic forms of thought such as they are currently developing via formal *neural networks* and *deep learning*.

We will not go further here in this direction, which would require experiments and studies that still have to be imagined.

Provisional conclusions

The so-called "rational thinking" is probably not thought at all, but rather a methodical organization of the results of far more "wild" thought processes whose biological roots today begin to be guessed. That this methodical organization of results has its source in the spirit of Greek geometry from which the mathematical demonstration is born is obviously undeniable, but the baroque re-modernization of this ancient Greek spirit is clearly of bourgeois and industrial origin. This might have directly been found in the etymology of the word "ratio", which is related to accounting and calculations. Now, which is the class that counts and calculates? The bourgeoisie of course ! Which incidentally is a merchant class, and must therefore endeavor to convince by means other than the brute force that is more generally used by the aristocracy, the nobility, and the various variants of mafia organizations. Surrealist vindictiveness against rational thought is hence certainly not unfounded, but Surrealism should have better understood the nature of what it was confronted with and the real identity of its enemy and therefore also have a better understood its own nature and of what sort of revolt Surrealism was the thought. This does not seem to really have taken place, either in historical surrealism or even in the course of the Situationist adventure.

To identify the bourgeois origin and nature of "rational thinking" certainly does not mean anathema or rejection in this respect. The bourgeoisie has accomplished great things, great and very good things, and also ugly and very very bad things. Human emancipation usually progresses by *moving beyond* and to step beyond has never been based on anathema or rejection. It rather means to experiment and to understand, consciously or not.

Important results of poetic and artistic thought emerging from the late symbolism (Rimbaud, Mallarme, Valéry), Dada, Surrealism and the Situationist adventure³² are now beginning to be at least partly validated by biology and the sciences of the mind. It is extremely dangerous and even disastrous for a movement of thought to be victorious to

³²And even of Pataphysics, the science of imaginary solutions - as if there had ever been others kinds of solutions

such a point. This raises the question of how this thought will now continue (and it must do so !) . Despite the current obvious and general low level of poetic and artistic thought, it may seem dubious that art is dead, and much more likely that it will have to move on other grounds and with other tools that will perhaps no longer make it identifiable as the pursuit of the same adventure by other means and in other territories. It is very important and even critical that the thought of the imagination continues in many respects, especially taking into account the fact that any poetic crisis is the symptom, effect and cause of economic crises and, more generally, of civilization crises including those currently in progress.

The irruption of current developments in Artificial Intelligence is only to be feared due to the orientations and forces that currently rule Artificial Intelligence development. It may seem obvious that the ongoing propagation of the neoliberal ideas of a competition between man and machine is highly ridiculous³³ but extremely threatening, for at this idiotic game mankind has everything to lose, even its very existence. Intuition, observation and ... well the very reason itself should have long led to the natural, biological and obvious idea of a *symbiosis*, as has been the case for hundreds of thousands of years between men and their tools. It is not a matter of rejecting or accepting our tools, nor of denying or accepting Nature, but of *learning to live with it*.

Pierre Petiot - March and April 2017

33Tools... language itself is a tool . Is anyone seeking to know who is the strongest, of man or language?