

## FROM LINEAR THINKING TO COMPLEX THINKING

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**ABSTRACT:** CONTEMPORARY REALITY, IN THE NEW CONDITIONS OF GLOBALIZATION AND INDUSTRY 4.0 REQUIRES THE TRANSITION FROM LINEAR THINKING DIRECTLY TO COMPLEX THINKING. COMPLEXITY REQUIRES COMPLEX THINKING. ALTHOUGH IT DOES NOT PROVIDE ANSWERS OR RECIPES TO DEAL WITH THE UNFORESEEN, COMPLEX THINKING IS A REAL HELP IN DECISION MAKING. COMPLEX THINKING IS A CHANGE IN THE FORMS OF SCIENTIFIC THINKING THAT REFLECTS AND GIVES COHERENCE TO THE WHOLE. A SYSTEM IS COMPLEX WHEN THERE IS A NONLINEAR INTERACTION BETWEEN ITS ELEMENTS. THEREFORE, THERE ARE A VERY LARGE NUMBER OF COMPLEX SYSTEMS. TO STUDY, IMPLEMENT OR PRODUCE THEM, IT IS NOT ENOUGH TO STUDY THE ELEMENTS. THAT IS WHY COMPLEX THINKING IS NEEDED.

THIS ARTICLE ANSWERS SOME QUESTIONS WITH MAJOR IMPACT IN THE CONTEMPORARY WORLD:

HAS THE WORLD BECOME MORE COMPLEX OR DO WE THINK DIFFERENTLY ABOUT THE WORLD AROUND US?

HAS THE WORLD CHANGED OR IS OUR PERSPECTIVE ON IT CHANGING?

IS IT NECESSARY TO THINK COMPLEXLY IN A GLOBALIZED WORLD?

WHAT ARE THE LANDMARKS OF COMPLEX THINKING?

**KEY WORDS:** THRESHOLD THINKING, NETWORK THINKING, GLOBALIZATION, COMPLEXITY, COMPLEX THINKING, TRANSDISCIPLINARITY.

### Introduction

The great challenges of the contemporary world cannot be understood in isolation. Social inequalities, climate change, environmental degradation, poverty are all complex issues, ie interconnected and interdependent, which therefore require systemic solutions.

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Traditional education, as it is conceived today, encounters difficulties in perceiving this complexity, because it divides and compartmentalizes the fields of knowledge, reducing the dimensions of reality.

Complexity establishes the link between unity and multiplicity.

To respond to the complexity of the world, a reform of thought is needed. Only a thought that connects all the dimensions of knowledge will allow the transformation of human societies.

According to Edgar Morin, “(...) *complex thinking is primarily a connecting thought. (...) It is therefore against the isolation of the objects of knowledge; restores them in their context and, if possible, in the whole of which they are a part.*”<sup>5</sup>

Only by understanding and being aware of global issues can an individual be involved and act in the political, economic and civic spheres. Thus, education in complex thinking is the key to social change.

The introduction of complex thinking would be the cornerstone of human evolution. Changing our way of thinking in order to accept the uncertainty, incompleteness and contradiction is one of the major challenges of our 21st century, and this change will come along with digital evolution. Once we have become able to create an electronic superhuman, which will deeply disrupt our society, we will adapt naturally and, in the process, complex thinking will help us to achieve this. The digital revolution is already underway and it's time to think about it.

### **Linear thinking**

Linear thinking means using a simple and useful sketch to solve a problem.

Linear thinking itself is a metaphor according to which a chain of ideas appears on a line that we can see in sequential order. Analytical reasoning works when the logic "if A plus B, then C" is applied and universal laws or principles work in a predictable way. In the physical sciences, the fields of mathematics, physics, and engineering, as well as other fields of the exact sciences, are based primarily on analytical reasoning. Newton's laws of motion for bodies seem to work because they seem to be constantly reliable, measurable, and universal for material things.

Linear thinking, also called vertical or sequential thinking, is a problem-solving method commonly used by the human mind.

The term linear or vertical thinking was introduced by Edward de Bono in 1970, when he wrote about lateral thinking as a term of opposition. De Bono distinguishes between linear thinking and critical thinking because, although they have similarities, linear thinking implies that the person uses the method to find a solution to the problem.

Author Paul Sloane<sup>6</sup> has developed a method famous for developing and optimizing linear thinking. It is the system of situation puzzles. There are exercises in which there is always a problem and then a series of solutions.

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<sup>5</sup> Morin Edgar, *Introduction. La Pensée Complexe*, Editions Du Seuil, Paris, 2014. p.73

<sup>6</sup> Paul Sloane, *How to be a brilliant thinker: exercise your mind and find creative solutions*, KoganPage, 2010.

What is to be considered is that some of these solutions will be impossible, others will be possible and one in particular will be the most correct of all. This exercise has a double utility: the participant develops the ability, not only in linear thinking, but also in lateral thinking.

According to Paul Sloane, applying this type of exercise from an early age helps to mature thinking methods, provides emotional and social stability to the child, helps reduce aggression and has a positive impact on his intellectual life.

Linear thinking is the simplest model of thinking. It is a simple model of understanding, representing and explaining the surrounding reality, which is based on linear processes. The linear thinking model is a simple model with a low degree of approximation.

Linear thinking requires a process of analysis to then establish a series of steps in the model in which no mistakes can be made<sup>7</sup>.

The first type of linear thinking is natural thinking. This way of reasoning is characterized by spontaneous appearance. It is an impulsive way of thinking and no type of operation is used during it.

Another type of linear thinking is logical thinking, which establishes a sequence of reasoning in which the person is subjected to disjunctive questions, and for each question to answer affirmatively or negatively, to find a logical solution to the problem that has been asked to solve.

Another type of linear thinking is mathematical thinking. It is a more complex form of linear thinking that is based on mathematical elements such as rules, symbols and even different algorithms.

Linear thinking can be called vertical thinking is sequential

Vertical thinking is a type of problem approach that usually involves a selective, analytical, and sequential approach. Vertical thinking refers to the use of several conscious approaches through rational evaluation to make information or to make decisions. This type of thinking encourages individuals to use a sequential approach to solve a problem in which a creative, multidirectional response is seen as reckless. Vertical thinkers prefer to rely on external data and facts to avoid failure or counterfactual thinking.

Sequential thinking is logical thinking. Sequential thinking is thinking that follows logical reasoning, which leads to an idea that itself will generate another idea, and so on, in a sequenced way. It is a way of thinking favored by most individuals and encouraged and appreciated by the school system. This type of thinking produces a clear, structured, logical discourse.

In order to be able to assess the degree to which a person uses linear thinking, some tests that have been designed for this purpose are used.

The most widely used is the Myers-Briggs Test (MBTI)<sup>8</sup> which reflects how a person receives stimuli from their environment and makes relevant decisions based on them. Use four

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<sup>7</sup> C. Brătianu, *Strategic thinking*, ProUniversitaria Publishing House, Bucharest, 2015

<sup>8</sup> 5. Kevin Dutton, *Thinking in Black and White. About binary options in a complex world*, Publisher: Globo, Bucharest, 2021

axes to achieve this goal, which are combined with each other and create a grid with different possibilities. Then indicate in which of the axes is the subject who performed the test.

The axis that has the greatest weight for establishing linear thinking is the axis of intuition-sensation. The conclusion is that those subjects who have a higher score in "sensation" will be more likely to use vertical thinking.

### **Linear thinking vs. lateral thinking**

Lateral thinking introduces a creative component into the reasoning system that breaks with the rigidity of the scheme. It is a way of thinking that is not always based on logic, but requires imagination and the creation of mental scenarios in search of a solution.

The term lateral thinking, like linear thinking, comes from the publications of the same author, Edward de Bono. It is a concept that has gained enormous popularity, although it has also received some criticism.

It can be said that lateral thinking is the opposite of linear thinking. Lateral thinking involves the use of additional intuition, risk-taking, and imagination through unconscious and subconscious processes,

Linear thinking uses a sequential method to solve a problem, where only one solution is usually obtained. Lateral thinking can be seen as nonlinear thinking. Due to the nonlinear nature of lateral thinking, multiple solutions to problems are developed in more imaginative ways.

Lateral thinking is especially suitable for people who want to grow in creativity step by step and who do not believe in brainstorming.

Lateral thinking involves mental gymnastics, which de Edward de Bono calls "movement", which will facilitate discontinuous jumps between the real, the absurd and the return to the real<sup>9</sup>.

The effectiveness of lateral thinking is based primarily on the fact that the initial problem is clearly formulated. This involves the use of certain previous creative tools (functional analysis, monitoring, paradoxical questions, etc.).

The challenge takes place through a technique called step. It consists in introducing distortions, exaggerating or reversing certain elements of the initial paradigm.

It will be all the more effective if it calls into question the foundations of the system or the targeted approach. In fact, the challenge will often appear, at first, as fanciful, sometimes unrealistic, even transgressive. In any case, it does not seem acceptable a priori.

It is a kind of experimentation that we do in our minds, to make us deviate from the main path.

### **From linear thinking to complex thinking, crossing network thinking<sup>10</sup>**

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<sup>9</sup> Edward De Bono, E., Zimbalist, E. *Lateral thinking*, Curtea Veche Publishing House, Bucharest, 2019

<sup>10</sup> Guespin-Michel Janine, *Structure d'ensemble de la pensée complexe*, <http://penseeducomplexe.free.fr/pages/pages.php?title=accueil>, accessed on 12.06.2021.

Network thinking is intuitive thinking. Network thinking is, as its name suggests, made of branches (like the branches of a tree). An idea will generate 10 ideas that will generate every 10 others, etc.

Network thinking is not the prerogative of a person with high potential. Anyone can think of a network structure. The difference is that a typical person (with normal thinking) has to put himself "in the world of network thinking", because it is not his natural way of thinking.

The more creative a person is, the more accessible this form of thinking will be.

Thinking in a network structure is network thinking. It is a consequence of the multitude of neural connections in the brain. The thought sometimes unfolds in several directions, other times at the same time, each idea being divided into sub-ideas, by association of ideas or analogies. It is a networked thought: each idea creates a set of other ideas, which in turn creates other ideas, and so on.

Network thinking is the mapping of the mind<sup>11</sup>

Network thinking works the same as mental mapping. In mapping the mind, we represent a general idea at the center. Then we look around a set of branches of secondary ideas that are attached to the general idea.

Network thinking is an important and quick reflection activity, sometimes taking into account all the possible outcomes of a situation, all the aids related to an idea or all the possible solutions to a problem.

Network thinking is a form of thinking that is commonly found in people with high potential. People with high potential can often activate several branches of their network's thinking simultaneously: their thoughts develop in several directions at the same time. In this sense, network thinking is a different form of thinking, it is neuro-atypical.

Multiple connections often allow the creation of very creative and innovative ideas. The multitude of associative connections makes it possible to reach new discoveries, inventions and theories.

### **Complex thinking**

Complex thinking is a philosophical concept created by Henri Laborit during the informal meetings of the Group of Ten and introduced by Edgar Morin. The first formulation of complex thinking dates back to 1982 in the book *Science avec conscience* by Edgar Morin:

"The purpose of researching the method is not to find a unitary principle of all knowledge, but to indicate the emergence of a complex thought, which can be reduced to neither science nor philosophy, but which allows their intercommunication by operating dialogic loops 1. "

This concept expresses a form of thinking that accepts the interweaving of each field of thought and transdisciplinarity. The term complexity is taken in the sense of its etymology "complexus" which means "what is woven together".

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<sup>11</sup> C.M. Vance, et al. *Understanding and measuring linear-nonlinear thinking style for enhanced management education and professional practice*, Academy of Management Learning & Education, 6 (2), 2007

Edgar Morin presents "complex thinking" on 3 levels<sup>12</sup>.

The first floor offers the notion of organization and is based on three theories: information theory; cybernetics; systems theory.

The second floor is self-organizing. Add to the first level the notion of uncertainty and the order resulting from the disorder that it summarizes by the formula: order / disorder / organization.

To the last level / floor he adds three more principles that are specific to him: the “dialogic principle”; "Recursion principle"; "Hologram principle".

Complex thinking is an intellectual teaching that manifests itself through:

- The desire to get out of the disciplinary "prison";
- Epistemological awareness of the limits of science and reason;
- The rejection of science, the recognition of other forms of knowledge than science.

Complex thinking is an existential teaching that manifests itself on several levels. Thus, in the relationship with oneself it presupposes reflexivity and self-criticism.

In relation to others, it means paying attention to others, understanding before judging, the cult of love, friendship, brotherhood. And in relation to the world, it presupposes the awareness of an irreducible part of the mystery.

The differences between classical and complex thinking can be noticed in the following table:

• <b>Classical thinking</b>	• <b>Complex thinking</b>
• Excluded third party (or something else)	• Multiplicity of possibilities (multistationary)
• Analyze the separation, simplify	• Study a system.
• Immobilize the work (privilege the work)	• Study the dynamics of systems. Encourage interactions
• Reductionism (the whole is equal to the sum of the parts)	• The whole is more than the sum of the parts, but it depends on them
• Proportionality	• Non-proportionality, threshold effects, occurrence, phase transition, bifurcation linear causality.
• Linear causality. The main cause	• Circular causality (feedbacks) Multicausality
Hierarchy	• Self-organization
Studying balance or approaching balance	• Study away from balance (dissipative structures)
Order and disorder are mutually exclusive	• Order resulting from disorder.
• Determinism. Chance opposes necessity	• Non-predictive determinism, the importance of stochastic uncertainty

<sup>12</sup> Edgard Morin, *The Seven Knowledge Necessary for the Education of the Future*, Paris, UNESCO, 1999

• **Source:** Guespin-Michel Janine, *The revolution of the complex: issues and challenges*, University of Rouen, 2019

• **Think complex in a complex world**

• Thinking in a complex world is not simple, but it is necessary for any decision maker. Industry 4.0 brings its own share of uncertainties and challenges:

- from an economic point of view: the rapid adoption of new technologies (mobile Internet, artificial intelligence, big data and cloud) leads to a rethinking of business models and forms the human resource;

- from a social point of view: the evolution of work and the rapid development of social information networks leads to a rethinking of our political and social models;

- from an ecological point of view: the climate emergency implies a metamorphosis of production methods.

Thinking in such a context therefore requires some essential changes. "In order to manage ourselves in complexity, we need to change our mental patterns," explained Dominique Genelot, author of the famous "Manager in (and with) complexity", for example.

To bring this change to a close, we offer you ten essential principles drawn from the rich work of the French sociologist and philosopher Edgar Morin<sup>13</sup>:

• a. Changing the paradigm

It all starts and ends with a paradigm shift. It is a matter of going back a long way, to the origin of all our thoughts, in order to make a radical change: that of the transition from a simplifying thought to a complex thought.

This new paradigm is based on a fundamental rule that should be taken into account. "Distinguish without separating and associate without identifying or reducing," writes Edgar Morin in "Introduction to Complex Thinking."

This first principle has a double virtue: preparation for change and understanding its nature.

• b. Connecting

It starts with the keyword complexity, and the verb that summarizes everything is to connect. Etymologically, complexity refers to the Latin term *complexus* which means "that which is woven together." Therefore, in order to "think complex", the work of a weaver must be simulated by linking points of view, disciplines, levels of analysis.

• c. Application of the principle of irreducibility

Connection is not enough. The fundamental principle of complex thinking is the "principle of irreducibility" (Edgar Morin).

In order to understand the Other, this principle can be very useful because it invites us not to reduce the other to a few actions or speeches.

• d. Confrontation with contradiction, dialogic thinking

It is always necessary to oppose two or more arguments; the search for truth can only progress through controversy. In the Hegelian dialectic, in fact, this is divided in two and with the

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<sup>13</sup> Edgar Morin, *Introduction. La Pensée Complexe*, Editions Du Seuil, Paris, 2014

second term the opposition begins. Dialogic thinking makes it possible to understand by meeting two singular courts.

It is necessary to adopt a double logic (therefore dialogical): to think simultaneously about contradictions and complementarities.

“Dialogic reflection allows each party to understand the paradigm and vocabulary of the Other.

- e. Overcoming the agent / structure controversy through hologram

“Individual / society controversy” or “agent / structure” that can be summarized by this question: does the individual make society or does society make the individual? Reformulation of the question in complex terms: how does the individual relate to society? To answer this, Edgar Morin proposes the "hologramatic" principle.

In a physical hologram, each point in the image contains the entire image. So the whole (the whole picture) is in each part and the parts are in the whole. Therefore, society is in every individual (through language, culture, etc.) just like every individual in society (through their existence within it). Thus, the “hologramatic” principle implies a dialogical vision: the individual and the society, although they are antagonists, are complementary because they are included in each other.

- f. The search for recursion in any causality

Can we ask ourselves how society finds itself in the individual and vice versa? A new relationship with causality becomes necessary; a shift from linear causality (which would force a decision between one of the sentences) to recursive causality which could be summarized as follows: the individual produces the society that produces him.

This principle of recursion consists in considering any product as a producer or, in other words, any cause as a consequence.

- g. No fear of clutter

Here we are in a way of thinking that can quickly give way to disorder ... and therefore increase complexity. However, let us not give in to fear: according to the second principle of thermodynamics, all systems tend to disorder (we speak of "entropy"). Thus, thinking about complexity involves thinking about disorder / disorder and not running away from it.

This disorder can prove, as in a crisis, the source of a new order. Moreover, order and disorder maintain a deeply dialogical relationship.

- h. Think strategically

The various previous principles clearly emphasize the nature of the intelligence that complexity requires. So, in a complex world, you have to think strategically. Prepare for the unexpected and develop strategic information to take advantage of opportunities and deal with adverse dangers. The strategy allows, from an initial decision, to take into account a number of scenarios for action, scenarios that can be modified depending on the information that will arrive during the action and depending on the dangers that will arise and disrupt. The action.

Thus, the intelligence of complexity is a strategic intelligence, always alert, prudent and vigilant, which does not yield to its certainties.



- i. Every action is like a bet

Although "complexity requires strategy", action remains a problem for complexity, because action simplifies, separates, reduces, excludes the possibilities of others.

Therefore, we can think of acting as a "bet" informed by complex thinking. This notion of "bet" is essential to remember the uncertain size of any action and the prejudice involved in any decision.

- j. Self-criticism is daily hygiene

The last principle (and not the last): rather than criticism, it favors self-criticism. Self-criticism becomes a more necessary daily psychic culture than physical culture, an essential hygiene that maintains a permanent vigilance ".

### **Conclusions**

On the axis of complexity, linear thinking is the simplest model of thinking.

The processes in nature, in society and in our personal lives are not linear. Their complexity often exceeds our capacity for understanding, and in order to get out of this impasse, man has developed simple thought patterns with which to approximate the surrounding reality.

In real-life problem-solving situations, a combination of the two approaches, linear thinking and complex thinking, usually leads to the best results. Due to its rigid and structured nature, linear thinking tends not to include novelty in its methods, which is essential, for example, in finding and applying innovative management processes.

Linear thinking does not offer many opportunities to experiment and deviate from the established course. However, linear thinking helps to use details at every step of the way. On the other hand, complex thinking can take longer when we try to solve a problem, because it involves risk, the possibility to make mistakes and to learn from mistakes. If there is a problem, it is better to use linear and complex methods, because they complement each other and can help find the best solution.

Even if there is one hundred percent certainty that linear thinking can help solve a problem, you do not have to close the door on other solutions. It is always convenient to have several alternatives to a problem, so that you can choose the best one and find the most suitable solution.

Linearity is a limitation of the reality around us.

Therefore, complex thinking is the most developed form of representation of reality on the dimension of complexity. With its help we can understand the structure and process of a system, as well as its functional state. Managers must have the ability to think complexly to build the mechanisms that work and motivate people to learn and cooperate in teams to amplify the learning process and its generalization throughout the organization. An organization can have very talented and intelligent people, but if managers do not have the ability to think systemically, the organization cannot take advantage of organizational learning. It is vital to understand the limits of thought patterns and not let linear thinking dominate complex decision-making processes. Linear thinking remains efficient and useful thinking, but only for simple processes in which linear approximation does not lead to large errors.

By creating machines according to his image, man will understand his humanity and adopt the complex way of thinking.

On the other hand, it can be said that linear thinking is for a small area, and complex thinking is specific to globalization.

Complex thinking concludes, "Help yourself, and complex thinking will help you."

### **Bibliography**

- 1.Brătianu C., *Strategic thinking*, ProUniversitaria Publishing House, Bucharest, 2015
- 2.Capra, F .; Luigi Luisi, P., *The Systems View of Life: a unifying vision*, Cambridge: Cambridge University Press, 2014.
- 3.De Bono, E., Zimbalist, E. *Lateral thinking*, Curtea Veche Publishing House, Bucharest, 2019
- 4.Dulcan Dumitru Constantin, *The Brain and the Mind of the Universe*, Libris Publishing House, 2019
- 5. Dutton Kevin, *Thinking in Black and White. About binary options in a complex world*, Publisher: Globo, Bucharest, 2021
- 6.Guespin-Michel Janine, *Structure d'ensemble de la pensée complexe*, <http://penseeducomplexe.free.fr/pages/pages.php?title=accueil>
- 7.Morin Edgar, *Introduction. La Pensee Complexe*, Editions Du Seuil, Paris, 2014
- 8.Morin Edgard. *The Seven Knowledge Necessary for the Education of the Future*, Paris, UNESCO, 1999.
- 9. Sloane, P. *How to be a brilliant thinker: exercise your mind and find creative solutions*, KoganPage, 2010
- 10. Vance, C.M. et al. *Understanding and measuring linear-nonlinear thinking style for enhanced management education and professional practice*, Academy of Management Learning & Education, 6 (2), 2007