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Simplexity, teaching and movement

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Abstract

Alain Berthoz, contrasts with the complexity term, the word “simplexity” indicating a property of living beings, which over time have learned to develop increasingly sophisticated solutions to process an increasing number of information. The simplexity is what gives meaning to simplification, since the simplexes solutions are guided by an intention, a purpose, a function. This theory can become an instructional scaffolding that supports both the student, and the teacher in the teaching-learning process. The simplexity has to be ascribed therefore, between those which constitute innovations in education.

Educational Technologies simplexes show an operative strategy towards new forms of implementation, able to conjugate effectively with the current views of teaching, giving the body a central role in learning.

Currently, the school excludes the component body underestimating the role of the body in motion as a main device through which, creating experiences, we develop learning and produce knowledge.

From the studies conducted, it is clear, as today the body represents a machine of knowledge, so the abstraction and generalizations can produce useful learning only if they have been built from the experience of the world body. To this end, in our project we have tried to combine the learning of mathematics with the bodily component, all referring to the principles of simplexity.

Our goal is to give life to a teaching able to activate a plurality of interactions and stimulate various body mechanisms from which derive the processes of signification and meaning attribution.

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1. Introduction

A. Berthoz, opposed to the term complexity the word "simplicity," which is not a mere synonym of simplicity, as in the English-speaking world since the 50's, but a property of living beings, which over time have learned to develop increasingly sophisticated solutions to process an increasing number of information.

The simplicity like the complexity is not simple to understand, and therefore even to illustrate. To fully understand it, it seems correct, in this context, to consider the reasons that pushed A. Berthoz to seek a new strategy to deal with life and the world. It all starts here: the complexity.

1.1 The complexity

The last decades of 20th century witnessed an epic revolution in scientific thought, a revolution which in some ways is not fully completed yet, but it has opened the way to an irreversible path in the history of science. About this revolution there has been talked of chaos, non-linearity, holism, disasters and more, but the concept that best embodies and expresses the character of the new line of thought is complexity. In a short time we had to accept a series of changes in the traditional view of nature that, despite the variety of application areas explored are based on two fundamental principles: the effects are not proportional to their causes, and the whole is more than the sum of the parts. These principles were present in science even earlier, but were considered as non-essential characteristics of nature, contingencies which with appropriate approximations could be eliminated without affecting the deep understanding of the phenomena. Instead, the development of the new science has shown how nature, from the level of elementary constituents to the one of more structured biological systems to the human social and economic network, is intrinsically and irreducibly complex.

Niklas Luhmann introduces additional elements in the complexity characterization, he says that an event if is complex if it consists of so many elements that they can be put in relation to each other only selectively.

The greater is the amount and variety of relationships between elements of a system, the greater is its complexity. The main goal of complexity theory is to understand the behaviour of complex systems. Complex systems are systems whose behaviour can not be understood from the behaviour of the individual elements that make them up because they interact, the interaction among the individual elements determines the overall behaviour of the systems and provides them with the properties that can be completely extraneous to the single elements. The autopoietic concept is important when talking about the complexity, Maturana and Varela defined autopoietic unity as a unit that is capable of self-generating through a network of reactions that take place within a confined space.

This speech leads to another image representing the life as a system that follows a cyclical logic, an organized system, which generates a network of reactions, for example a metabolic one, but, generally, any network of reactions, which in turn generates molecular compounds, then re-assembled in the same system and so on, in a cyclical logic where there is no beginning and no end.

1.2 The complexity of human being

We talk about complexity and movement not only to emphasize how complex is at a neuronal and muscle level the possibility of performing the simplest of movements, but also because the movement allows us to build actions that face complexity. So thanks to the movement we express ourselves, and through it we explore the world around us, a complex world, in fact, that could not be tackled without a previous experience, deriving from body exploration.

Today we live according to the principles of disjunction, reduction and abstraction, which together form what Morin calls the "paradigm of simplification." To formulate this principle, which is fundamental for the West, it was Descartes who divided the thinking subject (res cogitans) from the body (res extensa). This principle has
allowed us to analyze the world as something distinct and distant, so that science, philosophy and other disciplines did enormous progress. We have had the consequences of this way of conceiving reality, only since the twentieth century. This conception brings science to be completely separated from philosophy and this entails, without a doubt, the inability of science to reflect on itself. The only way, according to Morin, to solve this problem has been another simplification, and more precisely the reduction of the complex to simple. This means discover that behind the apparent complexity of the phenomena, there is nothing but a perfect order, simplified, if we can say so by mathematical formulas and equations. With the introduction of complexity science the world has ceased to be linear and Cartesian dualism has been replaced by a dense network of interconnections that made it difficult to distinguish the individual parts from the whole.

1.1 Complexity VS Simplicity?

This collection of fascinating thesis - often enclosed in the expression "order from disorder" - has stimulated Alain Berthoz, to lay the foundations of a new theory, which based on the same principles of complexity tries to go further. According to the author the excessive propensity to complexity, expressed by contemporary societies, has been the main cause of the simultaneous increasing of methods aimed at simplifying complex situations, which, paradoxically, have produced a further increase in complexity. To make computers easily usable by anyone, very complex programs have been developed, so that "the more the use of computers is simple, the more the software will be heavy." The conclusion reached is that Berthoz "simplify comes at a price." Simplify for our brain has a price, but it is a necessity, since it cannot store the excessive bombardment of information that every day, indeed every millisecond, it is exposed.

Very often people make the mistake of confusing the word simplicity with that of simplicity and yet they are two concepts differ materially because simplicity means the absence of complexity, while the simplicity is deeply linked to the complexity.

2. The Simplicity

The simplicity is a property of living beings, is a set of solutions found by the latter so that, despite the complexity of natural processes, the brain can prepare the deed and anticipate consequences, identifying faster solutions, more effective and stylish, this in relational processes allows to predict the reactions of others.

The simplicity is therefore a decipherable complexity because it is based on a rich combination of simple rules.

More over it is important to emphasize that each organism has its own rules of simplification, these vary from individual to individual also according to its own Umwelt, namely the relationship that the subject has with the environment of belonging, and its relationship in it.

As stated by Uri Alon observing the biological phenomena of living beings genetic make one a words we can use to defined them is surely be "complex". As each protein is similar to spaghetti tangled and held together by atomic bonds. Yet these relations are simpler than you might think, as starting from a limited and small number of basic schemes. The fact that the basic patterns are limited and the like, gives a striking example of what is the simplicity from the genetic point of view and biological. Indeed identical or similar patterns are used in all living beings to minimize the energy and increase the speed of processing of the information.

There are properties of living organisms that constitute fundamental tools for a better definition of the simplicity concept:

Separation of duties: the dimension of time is a matter of separation of functions, there are indeed some molecular entities who work more quickly, whereas others operate more slowly, what to facilitate the distinction of the different tasks. This separation of functions is also visible in motor control and perception, where there are tonics, slow and steady systems and rapid and transient systems, both systems cooperate.
Differentiation: namely modularity, differentiate tasks within a company or organization allows a greater efficiency.

The rapidity: it is based on anticipating and predicting the consequences of an action. This is seen for example in the human being implementing motor action anticipating the danger of an obstacle that would result in the fall, the motor action is in fact active in 100 milliseconds. This property can also be found in some of decisions taken, that sometimes occur in a fraction of a second. One way to make quick and easy a solution to a problem is called "diversion simplicity" which takes up the mathematical model of Thom, or focus on special features, bifurcations and critical elements of a problem and simplify everything else. To put it in a Cartesian way: decompose the problem into a series of easier sub-problems broken down into modules and then recomposing.

Reliability: this property does not link well to the concept of complexity, especially if the person in question is the human being with its different facets to the molecular and cognitive level. To increase the reliability of these processes, we make use of tools such as: the redundancy, the use of paradoxical noise, cooperation between inhibition and excitation, the use of coupled oscillators.

The flexibility and adaptation to climate change: is the ability of an organism to act in different ways to solve a problem depending on its type and know how to deal with new situations. An example may be in teaching what the teacher arises in explaining the decimal numbers to a class, the easiest and fastest way would seemingly be to implement a lecture, but the risk is that the class is not able to internalize the concept. The solution semplessa instead is to create a new method of teaching, for example based on the embodied cognition, that even if requires more time ensures a greater stimulus for students and as a result an internalization of the concept, ensuring that the teacher has a solid foundations on which to build more complex concepts.

The memory: the memory of a past experience is vital to deal with the present and to predict the consequences of future action. The division of different areas in the memory refers to the mechanism of modularity.

The generalization is especially crucial in the movement, it allows us to move in space and is at the origin of human thought.

2.1 Simplicity and movement

Our body and the organization of infinitesimal connections it has with our brain are explanatory of what we mean by simplicity. The movements we continuously make with our body, from the simplest to the most complex, are faithfully subject to the simple laws.

Berthoz in his book "The sense of movement" describes the laws simplifying the movement.

To delineate them he invites us to describe an elliptical path with a finger, pointing out how the speed varies along the orbit: where the curve is reduced you progress faster, hence the tangential velocity. A very important law is the basis of this phenomenon: the power law 1/3, which binds the tangential velocity to the radius of curvature. The origin of this law is simple as it leads to reduce the energy to a minimum and consequently also the jerk, that is the speed of variation of the acceleration of a movement. There is also a very close relationship between the velocity along the trajectory, the curvature, and the twist, the speed is determined by the degree of twisting of the body segment under examination. Many authors argue this law is also the basis for the perception of movement.

Every movement of our body is the result of the combination of basic motor patterns, defined primitives of motor actions, they belong to a wide range of movements inborn or acquired during childhood. The combination of primitive motors makes possible movements such as walking, grasping, postural control, avoidance. These synergies are limited, but they can also be acquired through training, also thanks to mirror neurons we simulate the easier movement as much as we perceive them as family. On this basis it is possible to recreate the movements against nature if you practice with intensive practice, because our brain is able to reorganize their functional connections.
2.2 The gesture

Continuing to outline the movements of our body that respond to the principles of simplicity, we can neglect the significance of the gesture.

To the Greeks and Latins the gesture, or the actio must express the movements of the soul according to four registers:

- the physiognomy (vultus);
- the voice (sonus);
- the gesture or movement (gestus);
- the gait (incessus).

The gesture is more than the simple and the complex, because he embodies the simplicity.

It's simplex because it allows our brain, in a concise and straightforward to grasp a reality, an intention, a thought, a complex social relationship.

According Berthoz we can distinguish three broad categories of action:

- The gesture can also be a form of simplified coding, as it can be for example a military salute, the codes of the army or even the gestures that performs a traffic cop at an intersection;
- Finally the gesture can also be a sign of an emotion, intention and thus have a more abstract sense.

The fact that we communicate through the gesture implies the other in his own body. According to the philosopher and psychologist Theodule Ribot emotion is first of all "e-motion" then leaves from movement. The gesture represents the very essence of simplicity of living organisms.

The simplicity assumes that the brain has information, not just the word, to give a sense of the gestures. Information can not only come from the outside world, but there must be some link between the nature of the information and the laws of operation and interpretation of our brain. So we need to learn the meaning of gestures that relate to human relationships, social norms or religious symbols.

Verbal language is undoubtedly essential part of communication between human beings, in fact, has allowed a rich repertoire of trade, it undoubtedly belongs to simplicity as it allows to simulate reality by replacing a series of signs and symbols.

However, the verbal language is not the only way that men have to communicate, non-verbal communication, which has been long underestimated in itself has got a lot of communicative potential. Men, like animals, have in fact a form of non-verbal communication based on the body, on movement and gesture.

The repertoire of gestures is very vast and is always accompanied by attitudes or postures, gestures are not only the expression of the body but the whole person.

Why do we define the gesture simplex? The gesture is a manifestation of simplicity because it is an immediate summary of the complex reality, it contains the essence of what it is to act and not just the action, reflecting both the intention and the context. It also takes into account the psycho-physical characteristics of the person who does it, it can also be an anticipation of future action. Finally, we have an immediate perception, as in the act there 's evidence.

Doing complex and specific gestures is not always easy, but with practice you can hone all the gestures, make them faster and gain a very personal form. The initial hesitations, the need for multiple points of reference are replaced by security, the mastery of gesture and elastic adaptability. The gesture becomes unique and no more fragmented, it needs very few points of reference, so the movements are concatenated as the notes in a melody.
3. The simplicity, movement and teaching

Currently, most of the technologies used in schools excludes the component body underestimating the role of the body in motion as a "main device through which, realizing experiences, we develop learning and producing knowledge" (Rivoltella, P., 2012) - "and refusing to" look the corporeality teaching as a real situated practice and consider the results of teaching as the final product of a complex non-linear "explainable" (Sibillio, M., 2011).

A scientific reflection on the body as a "machine of knowledge" (Varela, 1990), thanks to that "the abstraction and generalizations can produce useful learning only if they have been build from the experience of the world body" (Rivoltella, 2012), would favour a necessary diversion of educational research towards strategies to exploit technologies able to reproduce and amplify in the digital environment, many of the mechanisms that the body puts in place to deal with the complexity of the Umwelt in which inter-acts (Berthoz, 2011 p. 14). In fact, the opportunity to activate a plurality of interactions able to stimulate various bodily mechanisms from which origin the processes of signification and attribution of meaning, can help to enrich the boundaries of experiencing in education, widening the opportunities to decipher the complexity the process of teaching-learning "More generally we can say that the complexity of the world can be easily overcome if our brain processes some consistency between the components of the real" (Berthoz, 2011 p.55).

In this sense, the teaching techniques simplex "showed an operational strategy to a specific perspective of" ergonomics teaching": the deviation from simplistic strategies for selecting technology, towards new forms of implementation are able to conjugate effectively with current pedagogical visions, returning to the body a central role in the relationship technology/learning and recognizing the action the ability to make possible, and at the same time, "exercise", a projective-cognitive function; "projective the brain is able to evoke a complete scene to interpret the world as it has been perceived and experienced in a given time in the past "(Berthoz, 2011 p.58).

The movements are not a pure mechanism, a means to achieve something, motor actions play an important role in the formation of the mind, affect learning and are the basis of language. Movements, motor patterns and physical relationship with reality develop the mental logic and opens up the thought. Generally when we think of mind we focus more on the perception and ideas but not on the move yet even the latter has a fundamental role in the mental representations. Very often it is believed that the action starts from a sensory perception which is follows a cognitive processing which then gives to life motor act. But you can also find a pattern not so linear, but cyclical, the body that interacts and changes the surrounding environment, the perception of consequences and the influence it has on the successive movements. So thinking is simply to decide which move to make then, from this point of view the movement is not the means to meet the demands of the mind, but is the mind is to meet the demands of the action.

This way of looking at reality may seem somewhat paradoxical because motor functions are often considered low-level, subordinate to that which is pure thought.

As mentioned previously, however, the body is closely related to areas of the cortex responsible of real or imaginary movements, in other words the same area of the brain comes into operation when we imagine a movement or when this is planned.

According to some neurophysiologists as William Calvin the evolution of some motor behaviours, such as the ability to construct and manipulate the objects, has meant affirm a logic motor based on the structuring of a concatenated sequence of steps: as the motor cortex and the pre-motor have developed a sequential capacity inducing an area, that of Broca that controls the drive of the language, to generate the sequences of syllables that lead to the word.

There is a close interplay between motility and thought, from the point of view of the natural history of man, from the ontogenetic point of view, and from the point of view of functioning of the mind, in fact now focus on a problem and consequently to think leads to a tension of the muscles of the neck.
3.1 A new perspective on teaching and educational

The profound changes that have altered over the years the society in its social, economic, cultural and professional in fact have also transformed the educational systems and training. The advent of new communication and information technologies have created new possibilities for each person to have access to information, to knowledge, involving a change in the skills required to understand and act in the current social, national and international contest and to carry out their functions. The change of the society brings as a consequence the transformation of the demand for education and training.

It is then proposed a not self-referential school, but open to society, the processes of change that can improve its educational effectiveness in terms of outcomes of training. A school that expresses its offering educational curriculum and taking into account a possible coalition between body, mind, and language by taking a playful approach. This new perspective takes into account especially the new concept of simplicity discovered by A. Berthoz, as today to cope with the increasing complexity it is necessary that not only the individual human being implements simplex solutions, but also the school to embrace this concept to enhance and facilitate their students learning.

The work comes to life from the theories of authors such as P. Dennison "movement is the door of 'learning', McLuhan" there is no learning without fun and there is no fun without learning ", A. Damasio "research has convinced me that emotion is an integrated part of learning.", A. Einstein "means learning experience, anything else is just information."

It has been questioned whether in fact to meet the needs of the application you can find a simple solution that will stimulate students and will be therefore not only effective, but also innovative, in specific case for learning the English language. The solution that fully reflects the simplex principles has been in our opinion the possible coalition between body, mind, and language.

The project seeks to undertake a practical study, and not just in theoretical level, that having "the purpose of identifying the body both didactically accessible resources for the promotion of knowledge, and the physiological properties responsible for the 'adaptation' of the body to 'environment and turn them into principles of simplifying it a didactic act." The idea was born from the need to promote innovative methodologies in the school for the learning of a foreign language. With this new strategy is expected teaching to be based on full immersion of student in the language as a foreign mother tongue, like the mother of the rest, is a dynamic character, so it must be learned not as a simple idea to leave in a dark drawer of mind, but to be in constant use, to express needs, to solve situations. And this is the reason why it was decided to associate it to learning body, to emphasize and amplify that the participatory nature of this new teaching, which no longer provides a linear learning, but a cyclical one, where future experiences are to reinforce old ones automatically.

Thus we find a simple solution to the problem of lack of stimulation in the school, and now due to excessive static lectures, in order to improve the performances and skills of each student, in this case in the English language.

4. Conclusion

"Tell me and forget. Maybe show me and maybe I will remember. Involve me and then I will understand!"

The maximum of Confucius holds the value of the hypothetical research, because through our experience it could be shown that a coalition between body, mind, and language is possible becomes necessary as a new frontier for teaching that breaks the mould with the classical tradition of lectures and with aseptic mnemonic learning. The combination of these three elements might be understood to be the winner for the school of the future. A school that lays the foundation on the body, on the motion, on a new way of learning, a school in the name of a new goal, simplicity.
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