Didactics and “Simplexity”: Umwelt as a Perceptive Interface

PAOLA AIELLO, STEFANO DI TORE, PIO ALFREDO DI TORE, MAURIZIO SIBILIO

Abstract: This paper presents an approach to teaching within the simplexity framework. The authors present didactics as a complex science and highlight the link between mind, body and digital environment. Finally, the concept of Umwelt is presented as the basis to envisage new Educational Technologies that allow the creation of an “extended body”. Umwelt is intended as a Perceptive Interface that increases the range of action.

Riassunto: L’articolo presenta un approccio alla didattica nello scenario della semples-sità. Dopo aver proposto la didattica come scienza complessa e aver sottolineato il legame tra mente, corpo e ambiente digitale, viene presentato il concetto di Umwelt come base progettuale per tecnologie educative che permettano di realizzare un “corpo aumentato”, un’interfaccia percettiva capace di aumentare le possibilità d’azione.

Keywords: Didactics, Simplexity, Technologies of Education, Umwelt.

Didactics as a Complex Science

“Jusqu’au début du XX siècle – où elle entre en crise – la science “classe-sique” s’est fondée sur quatre piliers de certitude qui ont pour cause et effet de dissoudre la complexité par la simplicité. Le principe d’ordre, le principe de séparation, le principe de reductio, le caractère absolu de la logique déductive-identitaire” (Morin, 2002).

In the XX century we have witnessed a gradual and increasing crisis of this epistemological perspective, and it’s interesting to note that the first signs of the “crisis” have been just observed in some of the “natural sciences”, such as physics and biology, that more than the others had contributed to its spreading and legitimation. In particular, concepts like chaos, unpredictability and relativity of points of view are legitimated and assimilated in a new scientific perspective: complexity. Pedagogy and didactics, as other
sciences, have absorbed this new gnoseological conception, adapting their methods of research and their models to the new scientific scene. From the epistemological point of view, complexity, for its interdisciplinary nature, emerges as the study of complex adaptive systems and their related emerging phenomena. “Examples on Earth of the operation of complex adaptive systems include biological evolution, learning and thinking in animals (including people), the functioning of the immune system in mammals and other vertebrates, the operation of the human scientific enterprise, and the behavior of computers that are built or programmed to evolve strategies – for example by means of neural nets or genetic algorithms. Clearly, complex adaptive systems have a tendency to give rise to other complex adaptive systems” (Gell-Mann, 1995, 4). Complexity, in the educational research, is presented as a functional approach bringing back the attention to the complex and articulate process of human education, involving teaching-learning dynamics characterized by antithetic and complementary dimensions, constituents of a unique *interdependent, interactive and inter-retroactive* texture (Morin, 2001). Though it doesn’t exist an univocal definition of the concept of complexity, we could assert, even in the didactic scope, that complexity seems to be historically determined by the observer who acknowledges to the system some conventionally complex characteristics:

1. The presence in the didactic system of several components constituted by a variable number of elements that in turn can be simple or presenting different levels of complexity.
2. The presence of interactions among the *non linear* components of the complex didactic system forming the basis of an *emerging behavior* and recognizable in the *self-regulating* mechanisms of the system itself.
3. The “hologramatic” structure, reflecting the characteristics of the teaching-learning process, in which each component expresses information about the whole system where there’s no component that all alone can rule the behavior of single parts or of the system itself.
4. The adaptive interaction with the environment, that is the fundamental property of the didactic action (Sibilio, 2012a).

Thinking about didactics as a “complex science” calls the scientific community for a definition of its own object considered as the synthesis of teaching and learning interacting in a systemic perspective (Aiello, 2012). From an epistemological point of view, this concept has leaded to a clari-
lication of the methodological background traditionally attested on formal, theoretical and operative synthesis, nourished by systems of interconnection on several levels of analysis (Orefice, 2009).

The concept of complexity therefore stands out as the only approach that is able to offer to didactic research the complicated connection of elements interacting in educational processes, stimulating scientific research in gathering local modifications by means of approaches allowing the comprehension of data emerging from didactic system, though they act in full awareness of the impossibility of anticipating the future state. Indeed, if systems tending to balance, which are object of study of quasi-classical domain (Gell-Mann, 2000), can predict, after having described the initial state, the following states by means of the analysis of the perturbing elements, didactic system seems to be unpredictable, due to its interaction in a non-linear way, inside and outside, changing its structure and making necessary a re-modelling of its own characteristics in each state, causing at the same time either the impossibility of predicting the future course of the phenomenon, or a computational explosion due to the need of recalculating, at every state, the structure and the characteristics of the system itself. What does it happen to the educational research when the need of new representations and theoretical models require different ways of interpreting and coping with complexity? (Sibilio, 2012a).

Specifically, it means to answer to the need of a reduction of the dimensionality in order to offer new interpretative patterns, new ways of adapting and solving practices; these solutions don't misrepresent complexity, even if they can provoke a number of deviations, an apparent additional complexity, but sure they always can address problems in an original way (Berthoz, 2011). Therefore it's increasing a conception of didactics acknowledging to teaching-learning process its nature of complex adaptive system which needs an epistemological redefinition and refounding in order to consider and find new methods, tools and procedures of research required by complex systems. From this point of view, it seems to be very interesting to introduce the concept of simplexity created by Alain Berthoz in its homonymous work which emerges as the study of all properties and principles that living beings – complex adaptive systems themselves – use to decipher complexity.
Umwelt, Simplexity and Didactics

It doesn’t exist a forest considered as an objectively fixed environment: there is a forest for the park watchman, a forest for the hunter, a forest for the botanist, a forest for the wanderer, a forest for the nature lover, a forest for the carpenter and, at the end, a fabulous forest where Little Red Riding Hood loses her way (Agamben, 2002). With these words Giorgio Agamben introduces his consideration on environment, in relation to zoo-biological research made by Jakob von Uexküll and to “Die Grundbegriffeder Metaphysik” by Martin Heidegger, who in turn referred and commented von Uexküll’s work. Where “classic science saw a unique world which included all living beings organized in a hierarchy, from the most elementary species to higher ones, von Uexküll, instead, considers infinite varieties of perceptive worlds, all perfect and connected as in a huge musical score and however not in relation and reciprocally excluding” (Agamben, 2002).

The word used by von Uexküll to indicate this “perceptive world” is umwelt. Umwelt includes the world of things in environment, the perceiving world, the signs produced by the subject and by the objects, and all the actions that species are able to carry out. Above all, it includes the meaning of objects for each subject, and how they interact in survival and social relations of the subject.

In the description of dog’s umwelt Uexküll paints (literally) a room whose chairs and dishes constitute significant elements in canine world, unlike school books which are totally irrelevant for the dog. It has got an idea, a researching image. All the characteristics of objects are perceptive characters given from the subjects they interact with” (von Uexküll, mentioned in Berthoz, 2008, 17). Therefore umwelt is a dynamic and interactive concept defining the relationship between physical world and living beings, and constitutes the basis and premise of intersubjectivity (Berthoz, 2009), an interface where “the significance is conferred by the act of the subject” (von Uexküll, Müller, 2004).

The subject builds up its world in accordance to its basic needs and its action tools in a perspective which refers to Bergson, to phenomenological tradition and authors such as Husserl and Merleau-Ponty, to enaction concept proposed by Varela (Varela, Thompson, Rosch, 1992), to the second-order cybernetics idea by Von Foerster, until the Mille Plateaux by Deleuze and Guattari on a different level. Alain Berthoz proposes a perspective where the subject sails in its umwelt guided by a series of simplifying prin-
principles which optimize the process of perception-action and minimize, or even reset the computational need (Di Tore, 2012a).

“The price for these simplifications is, of course, the reduction of the understanding we have about the world; it creates an Umwelt” (Berthoz, 2009, 22). These principles recognize to the subject its role of active creator of its own umwelt and define the umwelt as an interface between an acting subject and a “Umgebung” that is the surrounding that our umwelt can’t incorporate (Merleau-Ponty, 1956). In this perspective, simplifying principles indicated by Berthoz, nucleus from which the author will develop the concept of simplexity, have to face a complexity measurable in terms of data elaboration and decision among different opportunities, in relation with the meaning of complexity developed by the hard sciences. “A measure that corresponds much better to what is usually meant by complexity in ordinary conversation, as well as in scientific discourse, refers not to the length of the most concise description of an entity, but to the length of a concise description of a set of the entities regularities” (Gell-Mann, 1995, 2).

Learning as main strategy to deal with complexity, is a typical adaptive process of living beings, which develops in the umwelt. “Cognitive abilities are to be seen as the result of evolutionary and developmental adaptations to an extremely narrow segment of the world as it is known to us today. This has for reaching consequences for epistemic considerations and perhaps also for management of cultural conflicts” (Singer, 2009, 39). Learning-teaching processes reveal themselves as complex dynamic and adaptive systems which differ for their attitude to grant the global coherence in non-linear interactions, similar to other complex systems which are the key for understanding complexity in nature. (Prigogine, Stengers, 1984) “We should think about learning environments in terms of the students’umwelten, because these contain the structures that students perceive and act towards. It is these umwelten that change as students interact with their peers, teachers, and material structures” (Roth, Lawless, 2002, 17).

Learning umwelt therefore (inter)act as a non-trivial machine. “A non-trivial machine is mathematically unpredictable because every time it runs a function it changes the state from which the function will run the next time. In this way the next run becomes unpredictable” (Brier, 2008, 17).
Educational Simplex Technologies

Umwelt can be then considered as a sort of perceptive interface, being a simplex principle itself which, together with other simplex principles, rules and guides all the processes that living organisms, and probably the other complex adaptive systems too, carry out in the relationship with their Umgebung. The umwelt is also conceived as a dynamic concept, partly biologically determined, partly built through direct experience. In this theoretic perspective body is no more considered as a simple medium between our brain and the external reality, and it becomes the main device through which, while living experiences, we learn and produce knowledge (Rivoltella, 2012, 109).

The idea of a new possible alliance between biology, pedagogy (Frauenfelder, 1994, 2000) and didactics, in this way, can be inscribed in a new theoretical background. Educational corporealities (Sibilio, 2012b) become in this way the support of a teaching science based on the assumption that “all doing is knowing and all knowing is doing” (Maturana, 1992, 27). In the educational thinking, both in didactics and pedagogy, the concept of body as the place of simplex processes and its relation with environment becomes the focus. Similarly, the link between mind, body and digital environment becomes the focus of educational technologies which seem to underline the need of a passage from technologies providing an “extended-mind” (Menary, 2010) to technologies realizing an “augmented body” (Di Tore, 2012b).

That is, technologies whose aim is to redefine, develop and give back to digital context the strategies that body carries out in learning processes, in full awareness that “motoractivity–not representationalist verisimilitude–holds the key to fluid and functional crossings between virtual and physical realms” (Hansen, 2006, 2). In the didactic and pedagogic field, therefore, attention moves from mind to person conceived as an inseparable unit of mind and body, orienting didactic-pedagogic educational research to new types of interfaces and H.M.I. (Human Machine Interaction) which consider “human body as an input device” (Harrison, 2010, 453). In this context, the NUIs (Natural User Interfaces) supporting an efficient use of body and senses, could represent a useful didactic tool (Di Tore et al., 2011). They indeed allow a more natural interaction with digital environment, integrating the digital realm to the user’s umwelt, increasing action possibilities and the opportunities of meaning co-definition, developing and redefining.
processes that body carries out to face the complexity of reality (Berthoz, 2011).

**Author's Presentation:** Paola Aiello, Stefano Di Tore, Pio Alfredo Di Tore, belong to research group coordinated by Maurizio Sibilio, full professor of Didactics at Department of Human, Philosophical and Educational Sciences, University of Salerno.

**Notes**


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