



For an *inclusive innovation*. Healing the fracture between the human and the technological in the hypercomplex society

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Abstract

Hurled into hypercomplexity, we are facing a complex process of *anthropological transformation*, of a shift in paradigms, models and codes, other than *an irreversible synthesis of new value systems and criteria for judgment*. Our extraordinary scientific discoveries and technological innovations not only open dizzily onto as yet unimaginable horizons and scenarios, but show, ever more clearly, the urgency of radically *rethinking education*, teaching and training, and of a *systemic approach to complexity*, which in the meantime has become *hypercomplexity*, underlining the substantial inadequacy of our schools and universities in dealing with this *hypercomplexity*, in dealing with the indeterminateness and ambivalence of the ongoing metamorphosis, in dealing with the global extension of all political, social and cultural processes. The conceptual framework of this paper, therefore, has the following objectives: a) to provide a functional definition of complexity and hypercomplexity and of our limits in understanding them; b) to highlight the urgency of a systemic approach to complexity and of rethinking education and training beyond «false dichotomies» (education determines new asymmetries and inequalities, which in turn influence educational policies). The *social and cultural* innovation belongs to those who will succeed in healing the *fracture* between the human and the technological, to those who will succeed in redefining and rethinking the complex relationships between *the natural and the artificial*, to those who will manage to bring knowledge and skills together (*not* to separate them), to those who will, furthermore, know how to unite and merge the two cultures (scientific and humanistic), both in terms of education and formative training and in defining profiles and professional competences.

Keywords Paradigm shift · Rethinking education · Hypercomplexity · Systemic approach to complexity · Communication is complexity

From complexity to hypercomplexity

We can begin with the presupposition that complexity is an innate structural characteristic natural to human groups, to relations, to social systems, to the biological world and even to objects, with a few variations. As far as objects are concerned, we ought to speak of complicated rather than complex systems, since it is possible to break down the parts and analyze them in order to understand their behaviour and functions. These processes and phenomena are essentially linear and in some ways predictable and reproducible. Complexity, on the other hand, in particular,

the particular kind of complexity that regards society, organizations, human groups (and, with a few subtle differences, biological systems as well), cannot be dissected and categorized, insofar as it cannot be obtained or interpreted on the basis of linear models (cause-effect, stimulus-response). It is, therefore, an unpredictable and non-reproducible complexity which we can observe and comprehend especially through the multiple layers of connection between the parts (the objects) themselves, and in order to do so, we need to take a systemic view of the processes, the phenomena and the dynamics: a systemic view that calls for a completely different manner of observing “objects”: not only observing the sum of the parts or even the whole –keeping in mind, in any case, that the whole is always *greater* than the sum of the parts. In fact, there is a further element that characterizes complexity: the fact that we are talking about adaptable complex systems capable of modifying themselves to satisfy new conditions or

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requisites. In these systems the parts are not “inanimate”, passive or neutral, nor do they react only to certain stimuli in a predictable manner; they are individuals, entities and relations that are constantly contributing to change and to co-create the conditions of the interactions, of the framework of reference, of the ecosystem which they are part of. If we observe social organization or simply a group of people or even a random set of people seen together, not only will the totality be superior to the total number of people, not only will we be unable to understand the dynamics of the group by isolating individuals or narrowing our fields of observation, but we will be forced to realize that these same people (individuals, entities) are constantly modifying, co-creating, co-constructing the social environment in which they are immersed. And my very presence, my very act of observing will itself modify the conditions and the levels of interaction, exchange and sharing. If I want to truly observe and comprehend the constantly evolving relations and dynamics, I will have to learn to observe the togetherness, the globality, the connections, the systemic relations.

Furthermore, complexity as we grasp it is rapidly becoming *hypercomplexity*. In the current phase of global mutation we are living in, the passage from complexity to hypercomplexity is determined by a series of factors. Among these factors are significant increases in the quantity of intervening variables and concauses and in the parameters to be considered. The principal causes, however, are two complex variables regarding velocity and communication. To begin with, technological innovation, in particular the so-called *digital revolution*, which distinguishes itself from other phases of industrial revolution by introducing a “new speed”, has in fact sparked off a phase of extreme acceleration in the social, economic and cultural processes characterizing the ongoing changes. A second factor involves the ever more strategic role of communication, increasingly essential not only with respect to the vital functions of education and socialization processes, but also to the processes of representation and perception. These two factors are the most important driving forces we must consider as we become aware of the transition from complexity to hypercomplexity.

Whether what we are facing is *complexity*, *hypercomplexity*, or *(hyper)complexity* – at times drawing a distinction is an all but impossible feat – a systemic approach or method requires creating educational processes that aim towards healing the fracture that has fabricated false dichotomies between the human and the technological, towards fostering critical and independent thinking by incorporating doubt and uncertainty into our teachings, towards giving us the tools, from the first years of school on, for studying interconnections and interactions, which will enable us to perceive *objects* as *systems*, towards providing equal starting conditions for

genuine knowledge sharing and for an inclusive and participative innovation.

Innovation is complexity

Innovation is a complex process; or rather, it *is* complexity itself: education, teaching, training – obviously – must (should) be its supporting pillars, not mere instruments emerging downstream of the processes of change to correct any unexpected and/or unpredictable trajectories or discontinuities. Otherwise, *we will forever be forced to chase after the accelerations of technological innovation*, with very slim hopes of reaching them, and likewise, of metabolizing the changes that have been wrought. What we are risking is technological innovation bereft of culture, and a mere illusion of citizenship [1, 2] – a citizenship and participation which have not been socially and culturally negotiated and built within inclusive processes, but on the contrary have been forced upon us through top-down policies, created without empathy, without partaking – completely and concretely – in the future prospects of those on the receiving end of these strategies and actions, of those who are asked to exercise citizenship and participation and to nurture them, to co-construct the structural and socio-structural conditions and “re-produce” them constantly. This is still the dominant idea and vision of innovation, based on the principle of *exclusivity*: innovation for “the few”. The concept we are proposing, on the contrary, is that there is no such thing as true innovation without inclusion, which cannot be determined by mere technology, but only by the social and cultural processes of education. We are facing the necessity and the urgency of long-term and courageous strategic choices in the *interconnected* and *hypercomplex society* [1, 3, 4], whose implications increasingly regard, not only the possibility of adapting to or managing change (globalization, complex connectivity, the digital revolution, the sharing economy and society, new asymmetries of inequality, etc.; also see my definition of “asymmetrical society”) [1, 5, 6] but the choices themselves, the chance to choose between two kinds of liberty-responsibility, those held by citizens and those subjected upon vassals [1, 7–10]. Choosing participation or the “freedom” to be vassals. *With the Utopian illusion that we can go beyond the “freedom” to be vassals!*

Hypercomplexity is not – has never been – an option; it is a “fact of life” [1, 6]: we are facing a hypercomplexity that has extended so far as to make any attempt to provide/formulate reductive schemes extremely difficult and complicated. We are dealing with a kind of (hyper)complexity that has been further enhanced by the ever more strategic relevance wielded by communication and by technological innovations, not only in the processes of education and socialization, but also – and above all – in the representations and the perception of dynamics and of the systemic processes of evolution, that

evidently, also closely regards the production of fields of knowledge, of “instruments” and of scientific knowledge, which are essential precisely for the analysis and management of this hypercomplexity, other than of the *unpredictability* that distinguishes it (epistemology of uncertainty). Complex and problematic dimensions that also, in the light of a progressive redefinition of the *spaces of the (global) public sphere* and of its (dissolved) borders with the private sphere, also have an obvious impact on interpretations, public discourses and hegemonic narratives.

Objects as systems: the strategic role of education

The real issue is that we have never been (and are still not being) educated and taught to *recognize* this *hypercomplexity*: in other words, we continue “*to see systems as objects instead of vice-versa*” [6]. An inadequacy which has become even more apparent in this society of interdependency and of global interconnections: a “new ecosystem” [6] in which everything is (or at least, appears to be) linked and connected, within non-linear processes and dynamics, with many variables and concauses that must be considered. A hypercomplexity [1–4, 6, 8–24], that is – it should again be made clear – a cognitive, social, subjective and ethical hypercomplexity that touches every aspect of life and of praxes, and which consequently requires us to rethink our categories, our education, our “forms” of citizenship [25–29].

To put it in other terms, we must measure ourselves with a hypercomplexity that will force us to deal with several urgencies:

- The urgency to overcome the old linear and cumulative models that are still profoundly affecting the structure and the very organization of fields of knowledge.
- The urgency, once and for all, to go beyond the logics of separation and reclusion of fields of knowledge that, in reality, limit the educational and formative processes within individualistic dynamics that consent solely the transmission of knowledge, and not its communication and sharing.
- The urgency to overcome the traditional idea or view of learning as a process of accumulation of knowledge, in view of increasingly complex and articulate learning processes that are, above all, more and more oriented towards cooperation and collaboration.
- The urgency, not only to reorganize didactic-formative itineraries, encouraging interdisciplinarity and multidisciplinary (fundamental), but to actually reformulate the entire system of thought, increasing the *knowledge of knowledge* [30: Vol 3], with greater awareness.

What a complex question complexity is! And in coping with it, we cannot avoid once again considering one essential element: currently, cultural evolution is capable – as never before—of conditioning biological evolution, determining an anthropological transformation which further highlights the urgency of that paradigm shift we need so sorely. Because hypercomplexity is not an option, it is, as we said before, a “fact of life”; the real problem is that we have not been taught or trained to recognize it, or at any rate, not by using our own heads. For some time now, “*technology has begun to take part in the synthesis of new values and of new evaluation criteria* [6], bringing out, even more clearly, the centrality and the strategic function of cultural evolution, which is unrolling alongside biological evolution, deeply conditioning it and determining dynamics and retroactive processes (such as, for instance, the technological progress linked to artificial intelligence, robotics, IT, nanotechnologies, genomics, etc.)”. In other words, within the overall framework of a necessary rethinking, redefining and overcoming of the nature/culture dichotomy, we cannot skirt the issue of how the social and cultural mechanisms that characterize the statics and dynamics of the social systems are being more and more heavily contaminated with the well-known Darwinian mechanisms of selection and mutation. It is increasingly difficult, not to say misleading, to try to keep these two evolutionary pathways separate, and at the same time, it is becoming increasingly urgent to call for a multidisciplinary and interdisciplinary approach to complexity - there is an endless list of scientific literature on these topics [1–4, 6, 8–10, 17, 22–24, 30–43] - for the analysis and the study of dynamics that are, indeed, ever more complex, where the planes of discourse and intervening variables impact each other reciprocally, stretching the traditional linear theoretical-interpretative models to the limit.

Breaking the chains of tradition

We can, of course, carry on pretending that we haven’t noticed, but the ‘traditional’ borders between studies in the scientific fields and in the humanities (the “two cultures”) have in fact been completely done away with, owing to the extraordinary scientific discoveries and the continual accelerations brought about by technological innovation, which renders even more unavoidable the urgency of an education/training that teaches complexity and critical thinking (logic). However, a deep-rooted resistance to such a radical change of perspective (models, procedures, routines and instruments) hails above all from the very “sites” where knowledge is produced and processed, and is linked to motivations of various kinds: dominating logics, feudal social models, cultural issues, the primacy of politics in every dimension, amoral familism,

organizational culture, climates of opinion, and so forth. Essentially because in every field of individual and collective practice, innovation means questioning consolidated fields of knowledge and methods, upsetting individual and collective imagination, unbalancing equilibriums, *breaking the chains of tradition* [6], abandoning certainty to move towards uncertainty, with considerably greater risks (opportunities), real and perceived. In other words, rendering systems and their spaces for communication and relationships more vulnerable, at least temporarily. A strategic and crucial question for the *complex process of the social and cultural construction of the "Person" and the citizen*, and thus of the public domain, which takes on a fundamentally important role, in consideration of the constant and rapid transformation of the local and global contexts of reference.

The evolutionary process of the social ecosystems [6] is advancing towards a *redefinition of the relationships and asymmetries*, bringing forth the need for a "new social contract" [2]. Consequentially, a *reformulation of thinking and of the fields of knowledge* along open and multidisciplinary lines that directly involves both school and university becomes even more urgent, as they are unfortunately thought of and organized as separate entities whose policies should be designed with a systemic approach [31]; a reformulation of thought and of fields of knowledge from an open, multidisciplinary perspective, (obviously) capable of taking into account and enhancing the *specialization* of knowledge and skills, overcoming that distorted and misleading point of view that sees it as incompatible with the kind of approach developed through complexity and with complexity itself. All of this should then materialize into long-term educational proposals and strategies working to bring about the *social construction of change* and of an *inclusive innovation*. Let us keep in mind, though, that should these be imposed top-down, they will always reveal themselves to be an exclusive change, for the few and for a fleeting moment. It is necessary to realize once and for all that the real strategic "factor" of change and innovation is the cultural "factor", a complex variable capable, in the long term, of setting off and accompanying the economic, political and social processes. And the strategic level, once again, concerns *educational processes*, where the main roles are played (should be played) by schools, above all, and by the other *agencies of socialization*, whose areas of education and socialization, in these last decades, have been devoured by the media, networks and peer groups. It is a crucial level where it is possible to educate and to develop *well-made heads* (Montaigne) and not *well-filled heads* [44, 45]. Furthermore, it is this strategic level that should cultivate – or at least attempt to *cultivate* and put into practice – *empathy*, doubts, pluralism, the

acknowledgement of the value of *diversity*, for building open and truly inclusive societies founded on the culture of legality, prevention, responsibility, respect and non-discrimination. Lastly, it is a crucial level that can determine the socio-political conditions for reducing the hegemony of individualistic and egoistic value systems that have significantly contributed to the *weakening of social bonds* [5, 46–51] and communities. Pathways that inevitably end up crossing and eventually overlapping, and that have to do at the same time with scientific theory and research, school and university, citizenship and democracy, equality of starting conditions and inclusion. *Education and citizenship: education is citizenship, education is the opportunity for participation, education is inclusion.*

From this perspective, the correlation between education and citizenship/inclusion unveils itself to be even more obvious and consequential. Because it is not, and never will be, technology, or specifically digital technology, to determine citizenship and inclusion, or to create Montaigne's famous "*well-made heads*". In this sense, beyond these preliminary considerations, I especially wish to point out what, in my opinion, is another extremely tangible risk that we are running: that of believing (and consequently acting on the belief) that digital education – along with digital culture itself, or rather, digital cultures themselves – are merely "technical" issues regarding "technical preparation" and specific "skills", (exclusively) linked to the "nature" of the (new) *technologies of connection* and to the new environments and ecosystems of communication (other than, of course, to working and professional environments).

Going back to some questions we posed earlier, we cannot avoid pointing out our *inadequacies* in the face of the challenges and the dilemmas of hypercomplexity. Inadequacies, which are rendered even more apparent by the specific features of social complexity.

Social and (organizational) complexity, even in its particular characteristics, is always an issue of *knowledge and knowledge management* [1, 2, 8, 23], from which cognitive possibilities can effectively be selected, carried out and transformed into *choices and decisions* [52–54]; here it is impossible not to recall the Weberian finite section of *the meaningless infinity of events in the world* [55]. A kind of complexity, as we understand it, which has been expanding, and contrary to what one might believe (according to the so-called interconnected society, information and data = more rational choices and decisions), becoming even more unpredictable, notwithstanding the exponential augmentation of the dimensions of technological control [56, 57], owing precisely to the enormous amount of data and information. Not only do these data and information pile up without ever 'speaking for themselves', but they also determine a *permanent state of limited rationality* on all levels, from social to organizational.

Pathways in social and organizational complexity

Concerning social and organizational complexity, we are facing a social complexity which eludes the traditional systems of control and surveillance [58–61] and which requires a reformulation of thinking and a redefinition of the *fields of knowledge* [1, 6], which should play a part in reducing exactly that complexity, or at least in defining the conditions of predictability regarding behavior within and without the organizations and the systems. It is in this sense that Edgar Morin speaks about “thought reform”:

Thought reform would require a reform of teaching (in primary school, secondary school, university), that in turn would require a reform of thought. Clearly, the democratization of the right to think would require a paradigm revolution which would allow complex thought to reorganize knowledge and connect the fields of knowledge that today are confined within the disciplines. [...] Thought reform is a key anthropological and historical problem. This implicates a mental revolution even more important than the Copernican revolution. Never before in the history of humanity have the responsibilities of thinking been so huge. The heart of the tragedy also lies in thought. [38, 44].

Another “fact of life” is that we are not ready to face the challenges and the *dilemmas* of (hyper)complexity and of the new ecosystem, not so much in terms of methodology and research (and of the ever keener instruments of data collection), as in terms of theoretical-interpretative models that must (should) guide or orientate the empirical – not only scientific – observation of phenomena and processes. But what is needed is education and the teaching of complexity, along with a renewed awareness with respect to the necessity for an interdisciplinary and multidisciplinary approach to this very complexity, which entails redefining the spaces taken up by the fields of knowledge, and overturning those logics of power and control that have, at all levels, ratified the fragmentation and reclusion within the narrow “borders” of the disciplines, disciplines which are ever more isolated and incapable of communicating with one another – with deep-cutting implications extending well outside the ivory towers.

This is “the” problem, “the” issue, not the specialization of the fields of knowledge, an inevitable process, after all, owing to the advancement in research methods and data collection tools; a specialization which is often set up awkwardly in opposition to complexity and to a correlated approach, as well as to the concepts of multidisciplinary and interdisciplinary. The real obstacles, apart from the organizational cultures and the

dominating logics, are actually the separations and the disciplinary barricades – take, for example, the longstanding, and in some way, unbelievable distinction between the humanities and scientific studies, between humanistic and scientific training (one of the reasons for our current cultural lag, which is still wreaking so much damage) that not only stifles the observation and comprehension of reality (regarding both social systems and complex organizations), of social production and of knowledge sharing (backbone of the new ecosystem), but which also reveals itself to be incapable of reflecting that overview and that global perspective that our current social, political and cultural processes require. In this sense, I am still convinced, and on this basis I have developed my research, that technological innovation has always been a strategic factor of change in social systems and organizations, but that if it is not supported by a *culture of communication* and by a *systemic view of complexity*, and with respect to political deciders, by long-term social policies capable of sparking and supporting cultural change (strategic centrality of schools, education, universities), it will always turn out to be a “would-be” innovation. The knowledge society and the new global ecosystem [6] – which, for this and other reasons, I have preferred to term “Interconnected Society”, are destined to become more and more closed-off and exclusive, even in those settings where it is not possible to put up walls and barriers to manage diversity, inequality and conflict. *These are the seeds of what we have defined the “asymmetric society”* [1, 2, 8, 23]: *an apparently open and inclusive society that, in reality, guarantees opportunities of inclusion and mobility only along theoretical lines and within a purely legal frame of reference. The latter, necessary but not sufficient for building, and indeed, guaranteeing the pre-requisites for a complete, fully participatory, and non-hetero-directed citizenship* [25, 26, 28, 57, 62–65], as I have defined it in previous works [2, 9, 10].

For this reason, the issue is a cultural one regarding education in the first place, and also freedom, which entails responsibility! Moreover, beyond the social, relational and ethical dimensions, our youth, from the earliest years of school onward, are more and more in need of learning, living, practicing and applying “logic” (by the time the university years are reached, it is truly difficult to modify the structure of a *formamentis*, for instance by teaching students to use logic to develop and verify arguments). They are in dire need of a method for thinking, reasoning, synthesizing, of rendering systemic the (at times overly) enormous quantities of information received. In dire need of being introduced to complexity and to critical thinking, of an education that teaches and trains them to individuate the connections between phenomena and processes, between knowledge and life-experience that enables

them, for example, to critically evaluate the socio-historical origins of norms and cultural models, to reflect upon and distinguish “nature” from “culture” and “convention” (dichotomy that should be left behind once and for all); to see diversity and pluralism as fundamentally valuable rather than dangerous. In order to achieve such complex objectives, what is needed are long-term policies and a grandiose revival of studies in the humanities and of a humanistic background on all levels (schools, universities, research, etc.) [6, 9, 10]; as a consequence, the rest would fall into place almost on its own.

The crucial prerequisite of this analysis is that only the establishment and the widespread dissemination of a culture of communication (through knowledge sharing), within social systems [66, 67] in general and, in particular, within and without public administrations and business systems (the concept of organization as an “open system”) can effectively create the conditions for establishing those fundamental rights and duties of citizenship, without which the citizen-user-consumer obviously cannot receive any kind of legitimization or acknowledgement of his requests. Finding himself or herself, in reality, in a condition of subjugation within a completely inconsistent public sphere. The deep-rooted conviction of the author is that, in terms of praxis, the categories of risk [68–75] and conflict within the social systems and complex organizations are strictly correlated to a faulty and/or inefficient management of knowledge; or even worse, to the impossibility of accessing and using them in a mindful and rational manner. From this point of view, we will never tire of insisting on the crucial importance of a principle that can be considered banal or obvious only from a superficial viewpoint: those who “hold” more knowledge (in terms of control, possession, access and processing), similarly to those who control more information, will also be more powerful both in terms of interpersonal communication and of organizational or macro-systemic communication. In other words, at whatever level of analysis and praxis, whoever has acquired more knowledge, along with – at the current stage – whoever has a greater possibility to interpret it – and has acquired more skills (consider for a moment the strategic relevance of education, training and research for a nation-system) is indubitably better-equipped to guide the evolution of the dynamics and processes that characterize the social, economic and political rapports. Knowledge and skills are capable of determining the power rapports in every sphere of social, organizational and systemic life, with obvious repercussions on citizenship and democracy [76]. An “age-old” – but forever vital – issues: knowledge = power [1, 6].

The coming of a new velocity further radicalizes these processes and dynamics. *The new digital speed*, in its complex interaction with the human factor and with the system of social relations, preserves the original

ambivalence inherent to any factor of mutation and to every social and cultural process; an ambivalence that, aside from representing an extraordinary opportunity, also highlights our limits and inefficiencies – on personal, organizational and social levels – but above all, that leaves us too little time for reflection and for critical analyses of what is happening. In becoming conscious of this inadequacy, and of the irreversibility of these processes and dynamics, we realize that there is a tangible risk of focusing our attention exclusively on the technological and, more generally, on the applicative dimensions, once again underestimating the human dimension, regarding the people (the “Person” with a capital “P”), the system of relations, the educational and cultural contexts, the *lifeworlds* [77], the new asymmetries.

These issues, evidently, closely regard the definition and realization of those essential prerequisites which can trigger change and give us the tools for managing complexity and innovative processes: this is why we are facing such urgency in rethinking our schools and universities, still caged inside the “logics of separation”, which are the logics of controlling and of confining fields of knowledge into isolated disciplines. Issues and structural variables which, if they are not soon corrected, are destined to keep us in a condition of cultural backwardness with regard to the accelerations brought about by technological innovation; incidentally, this merely contributes to and reinforces the perception and the widespread belief in the “dual speed” concept of technology and culture, as though techniques and technology were something outside of culture and of the cultural-historical contexts that have produced and developed them. What is needed are significant investments in culture, in education and in schooling, within a general policy of revamping the humanities and humanistic studies, for too long considered unimportant because they are (at least, apparently) unable to produce “outcomes” that are “measurable” in quantitative terms.

Indeed, we must work on all levels (from individual to systemic) *to heal the fracture between human and technological* [1, 6, 9, 24], which, as history shows, cannot be accomplished by a top-down imposition, but needs to be built and processed socially, and, indeed, culturally.

Education, rules of engagement, empowerment

Today, what we call the *knowledge society*, with all of its risks and opportunities of inclusion, and at the same time, exclusion, represents the new Utopia of the contemporary world [78]: a global ecosystem where technique and technology will be more and more dominant and invasive [79, 80]; and as we are already beginning to see, where the main risk is that there will be less and less space for humans [9, 24, 81–83] and

human communication [6, 84]. It is in this sense that education and the teaching of critical thinking, complexity, and responsibility form the complex “instruments” of *social construction of the “Person”*, (in the first place), and of the “Citizen” (subsequently); instruments capable of defining the very structural conditions, as well as the *rules of engagement*, of the “new” forms of (global) citizenship and inclusion, correlated to the coming of the so-called knowledge society. These are fundamental and preparatory pre-requisites for (not only digital, but also and more generally) technological education – that require multiple levels of analysis and intervention. By no means, however, can we make do with merely enhancing our awareness of the many variables at stake. The so-called digital education must empower people (and citizens) to face and deal with the dynamics and processes, which have been set loose, not only through technological innovation, but also through the other numerous (economic, social, political and cultural) factors that characterize the new ecosystem; in such a way that young people (and adults) will be able to defend themselves from the “dark side” of the digital era, that they will know how to utilize the instruments and to *inhabit* the new environments, but above all, so that they will be capable of taking advantage of the enormous potential and the benefits offered both by the sharing of information and knowledge and by the construction/strengthening/intensification of the relational networks (communication vs. connection; inclusivity vs. exclusivity) [1, 4, 24, 85–94]. In the light of these brief considerations – which ought to be expanded and illustrated – digital education, and indeed, education itself, must be thoroughly reformulated by rethinking the bases as well as by redefining the main objectives. In the interconnected and hyperconnected society, precisely because we are living in the “new” ecosystem” [4, 6] and Rifkin’s so-called “*age of access*” [95, 96], in which the new inequalities (standing out more and more conspicuously) and the new asymmetries closely regard the access to immaterial resources, the ability to process and share knowledge and to organize it systematically and functionally. Precisely in this complicated evolutionary phase, then, digital education is in fact cut out to be – cut out to become – the base on which to build the new citizenship, both socially and culturally, the new *cohabitation*, rethinking the spaces for communication and relations, and attempting to redefine the “social contract” [2, 6]. Consequently, digital education must be re-considered (and crafted), in my opinion, not only as an instrument for technically preparing our young people, (along with teachers, directors, the “Person” and so forth) for the ongoing accelerated transformation, but it must be re-considered (and crafted) above all as a *culture of complexity* and as the *teaching of responsibility* [8, 97, 98], both founded upon an *epistemology of uncertainty* [30, 38, 45]. At the same time, it must be newly conceived of as a set of complex instruments capable of strengthening the effectiveness of rights and duties that are

essential for the very survival of modern democracies. Because it is not, and will not be, technology and/or all things digital to determine citizenship and inclusion.

At the risk of seeming repetitious, I wish to underline that I consider the following point fundamental: *complexity* and *specialization*, multidisciplinary and specialized areas are in no way antithetical, and by no means constitute, nor do they represent dichotomies. It is necessary to start over from the need for the fusion of theory and practice/research, knowledge and skills (not solely technical), human and technological, without falling into the (not merely didactic) trap of “useful” and “useless” fields of knowledge (on the question of the usefulness and uselessness of knowledge there would be much to say: this being the “concept” on which we are building our schools and universities). On these false dichotomies, after all, careers have been launched and areas of power, spheres of influence, unassailable ivory towers have been built, and many books have been sold; all of which of course, have wreaked regrettable damage on our youth, and more in general, on our cultural evolution, as yet left incomplete.

For quite a while, we have been pointing out the risks of a technological innovation bereft of culture and of a decline which, as in all of the more “advanced” countries, derives in part from our schools and universities themselves, which have been (at least partially) deprived of those very functions which are vital for a complete democracy. And we, as a community, are still paying a steep levy for the persistence and the consolidation of these “false dichotomies” [2, 4, 6, 9, 10], which form the neural networks of our schools and universities, structuring our research and the related didactic-formative pathways. The “world” and “reality” are (have ever been) complex, or to better put it, hypercomplex, but behind the public discourses that adopt (whenever convenient) those themes and questions that are considered in style (trends), we continue to keep these “two cultures” separate and to teach by using linear interpretative models – falling back each time onto deterministic and reductionist interpretations. Conclude with words I have used in previous works: “we must, therefore, become fully aware – not limit ourselves to parroting ideas – that the *social and cultural* future (which, as we have always said, is the “true” innovation), belongs to those who will succeed in healing the fracture between the human and the technological, to those who will succeed in redefining and rethinking the complex relationships between the natural and the artificial, to those who will manage to bring knowledge and skills together (and not to separate them), to those who will, furthermore, know how to unite and merge the two cultures (scientific and humanistic), both in terms of education and formative training and in defining profiles and professional competences. Leaving behind what I first called “false dichotomies”: theory vs. practice

and research [99]; scientific fields vs. the humanities; knowledge vs. competences; *hard skills* vs. *soft skills*.¹

Innovating means destabilizing

Taking special care, in doing so, to resist the continuous temptations, the short-cuts, the easy solutions (of certain kinds of storytelling that nearly substitutes reality), the reassuringly well-beaten paths that often conceal mere vested interests in power or in economic factors, the ideological views, which incessant promotion and event marketing have done so much to render visible, acceptable and approvable. *Innovating means destabilizing*. First of all, however, it is necessary to teach analytical and critical thinking to people, enabling them to use their own heads and to see “objects” as “systems”, (rather than vice-versa) [1, 4, 6].

It is necessary to radically correct the structural inadequacies and the appalling nearsightedness that has always characterized the institutions and the “places” in charge of the definition and *construction of the conditions for social emancipation*, not only by promoting an *analytical education on complexity and responsibility* (from the first years of school on), but *actively* rewarding and encouraging, in the real world, not only in institutional documents, interdisciplinarity and transdisciplinarity, and beyond this, even more importantly, in the world of scientific research. Which would have a meaningful impact on the didactic-educational pathways themselves.

For the sake of argument, if we were to imagine that politics and the allegedly *expert fields of knowledge* involved on a decisional level should decide to undertake these pathways, breaking loose from this distressing condition of “playing things by ear”, and at the same time, from the *excesses of reformism* linked to the *cycles* and the timing of politics, we would have to prepare ourselves to become accustomed to the idea that the results (the effects) of these strategic choices, which are of vital importance for cohabitation and for the very quality of democracy, will be seen (would be seen) only many years from now, because it is in the nature of these pathways to unfold in a long-term period.

In conclusion, therefore, we find ourselves *hurled into hypercomplexity*, facing a complex process of *anthropological*

¹ Regarding this last aspect, see in particular: “European Qualification Framework for permanent learning (EQF) and the Dublin Descriptors, two important references, albeit little-known even in academic circles. See also the text from the World Economic Forum (WEF) entitled “8 digital life skills all children need” where, among the “digital life skills”, there is also a reference, with an approach that absolutely fails to convince me – to “critical thinking”, where the oxymoronic term “digital empathy” is actually mentioned; hence I repeat once more, the problem is not just “skills”, aside from how we may grasp this important concept, for which an infinite number of definitions have been proposed, varying from the most highly specific to the most *universal* and all-inclusive.

transformation [6], of a shift in paradigms [37, 100] models and codes, other than an irreversible synthesis of new value systems and criteria for judgment. Our extraordinary scientific discoveries and technological innovations not only open dizzyly onto as yet unimaginable horizons and scenarios, but show, ever more clearly, the urgency of radically *rethinking* education, teaching and training, underlining the substantial inadequacy of our schools and universities in dealing with this *hypercomplexity*, in dealing with the indeterminateness and ambivalence of the ongoing metamorphosis, in dealing with the global extension of all political, social and cultural processes.”

As we said earlier, the real issue is that we have never been (and are still not being) *educated and taught to recognize hypercomplexity*. An inadequacy which has become even more apparent in this society of interdependency and global interconnections: a “new ecosystem” [6] in which everything is linked and connected, *within non-linear processes and dynamics*, with many variables and concauses that must be considered.

For these reasons, education (teaching complexity and critical thinking) is the most important innovation – and challenge – of our times.

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