

Innovating in the Post-anthropocentric era. A new framework for creativity

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Abstract

The Post-Anthropocene era profoundly influences human beings who need to develop new competencies and skills, among which creativity is one of the most important. Creativity, as the ability to generate a new and original outcome, is required to face complex social and sustainability challenges specific for an uncertain future, it can also help move towards a just and inclusive digital and green transformation. However, along with digital advancement, creativity transforms as well, acquiring new forms and through design future methods can be channelled to play the role of a guiding value. We should start to ask ourselves how to expand the definition of creativity to make it more inclusive to non-human agents and rethink the values and ethics involved in its process. What new skills, methods and approaches do we need today to design for a more-than-human world? This chapter presents a framework that redefines creativity in the Post-Anthropocene era from the authors' perspectives, and foregrounds four relevant dimensions to keep in a dynamic balance: Regenerative Creativity, Digital Creativity, Ethics and Futures Thinking.

Keywords: Post-anthropocentric creativity; Digital and sustainable transformation; Ethics; Futures thinking; Digital Creativity

Introduction: Transition towards Post-Anthropocene

Climate change, loss of biodiversity, depletion of natural resources, are just a few of the sustainability complex problems specific for our century. One million of the eight million species on the planet are at risk of being lost. Forests and oceans are polluted and gradually destroyed (The European Green Deal, 2019). Societal discourses have been evolving about what kind of transformation we need for the future, and what kind of futures we need to start imagining.

Companies, organizations and policy makers had already started to propose strategies to counteract the impact of the *Anthropocene* era, namely a geological epoch characterized by an immense and largely destructive human impact on environmental systems. For example, in 2019 the European Commission has launched the European Green Deal strategy defining a set of concrete measures to reach zero-net greenhouse gases emissions by 2050 and decouple economic growth from resource use. These strategies for **green and sustainable transformation** call for creative, interdisciplinary and international collaboration.

In this race, emerging digital technologies are considered as a critical enabler to attain the UN Sustainable Development Goals in various sectors and to ensure a sustainable, inclusive and better future for all¹. Indeed, meeting these goals require significant technological advances, where digital technologies will be key for improving the efficiency and sustainability of every aspect of our lives. At the same time, to stay competitive by preserving innovative potential and efficient operational capacities, companies and public sector organizations need to integrate digital technologies into their business processes, products, and services while remaining environmentally sustainable and reducing greenhouse gas emissions.

The market in which today's companies compete has a high level of complexity due to the dynamics created by the globalisation process, in which new competitors constantly come into play, and new needs and consumer profiles emerge.

¹ <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1576150542719&uri=COM%3A2019%3A640%3AFIN>

Moreover, the exponential development and diffusion of digital technologies is transforming the industrial economy and the associated job market, changing almost every aspect of people's lives, creating new customer needs and both significant opportunities and threats that need to be properly understood and managed. Innovation has become a fundamental requirement in the current socio-economic context for all companies that want to be competitive on the global market. Artificial Intelligence, Robotics, Virtual and Augmented Reality, and other **digital technologies**, are **impacting the process of creation and innovation, requiring companies to start the Digital Transformation** (DT) of their organization in order to constantly adapt to an evolving digital environment. Therefore, a sustainable transition of the European and global economy requires, as an essential component, its **digital transformation**. The digital transformation process involves the transformation of organisations, people, and technologies that drive companies to increase their digital maturity level (Aslanova and Kulichkina, 2020).

Individuals and organisations alike should be prepared, more than ever before, to face the multiplicity of uncertain futures, to anticipate possible scenarios that **guide innovation** and to be able to **take full advantage of the innovation capacity of digital technologies**. By taking a hybrid approach, blending human abilities and technical capabilities, companies and organizations can boost their digital transformation.

Even as we understand that the green sustainable and digital transformation will bring the humanity into a different post-anthropocentric future, we still do not have an ambitious vision of what this future might look like.

What does post-anthropocentric more-than-human world look like? There is a need to imagine, debate and co-create visions able to foster smooth and reflective transformation processes. At the same time, in order to ensure a sustainable and digital transition, a new set of skills is needed by individuals and groups; among these, **creativity stands as the most important for its capacity to help manage uncertainty and complexity** (WEF, 2020). People creativity will also need to be complemented by knowledge, skills and attitudes on climate change and sustainable development as well as envisioning and anticipatory abilities (Paraboschi and Dalla Rosa, 2016).

Creativity as a primary source of innovation, therefore, is a requirement in the post-Anthropocene era, a central skill that helps us face the complexity of the world today and move towards a just and inclusive digital and sustainable transformation. The fundamental questions that arise from this context are about the new requirement for creativity in the new era. How is creativity changing in view of the increased diffusion of digital technologies? What are the new relevant components of creativity able to ensure sustainable innovation?

Therefore, many disciplines, and particularly design, need to study and understand this evolution in order to develop new methodologies that empower people's creativity for a just and inclusive sustainable and green transition. The Human-Centred Design (HCD) approach, increasingly adopted by companies, has proven to be the most suitable when it comes to navigating complexity and uncertainty, innovating and transforming the surrounding challenges into business opportunities, exploring problems and co-creating solutions (Van der Bijl-Brouwer and Dorst, 2017, Brown, 2009,). Yet, our new relations to the natural world and critical approach to socio-technical systems, where designing for the comfort and convenience of the user can be damaging, call these previous understandings into question.

The objective of this chapter is to provide, first, an overview of the increasing relevance of developing creative abilities for innovating in a digital era, second what aspects will impact the creative process in the post-anthropocentric scenario, and lastly, we propose a framework of post-anthropocentric creativity which responds to identified future implications.

2. Rethinking the nature of creativity for innovation

The new reality we are experiencing, triggered by the climate emergency and rapid digital evolution enhanced by the COVID-19 pandemic, has highlighted the need for individuals and companies to creatively redesign their processes and go outside the comfortable area of the 'known', discovering what works for them and what does not. Only those organisations that are able to understand this quickly and orient their activities accordingly will be able to manage the transition in the best possible way. Many organisations have yet to apply digital technologies and to create a culture that embraces change, experimentation, and continuous learning and development. So how can organisations accelerate their digital transformation? The key lies in creating a vision for the future and steadily building the skills, technological and human, that help us achieve this vision. Creativity, in this context, has been considered a requirement and a democratic necessity for facing a just and inclusive transition (WEF, 2020).

Companies and organizations that want to innovate radically and increase their competitiveness on the market, or address societal challenges, must take advantage of the creative potential of their human resources. Navigating new and uncertain realities is extremely difficult because new behaviours and expectations take shape and evolve at warp speedily.

Radical innovation guarantees the ability of companies to differentiate themselves and have substantial impacts by adopting a *modus operandi* (mindset) driven by ongoing creativity and out-of-the-box, unconventional thinking applied to gain a deep understanding of the needs (manifest and latent) of both people and the planet. This type of innovation allows the pursuit of "new paradigms," "new meanings" of product/service/system that generate value and, consequently, enable organizations to assume a leadership role.

Therefore, one of the purposes of the green and digital transformation is to **increase the creative and innovative capacity of the organisation**, helping it cope better with the continuously changing digital environment.

Creativity, the production of novel and useful ideas (Amabile, 2012), has been widely studied by different disciplines, which leads to it becoming a complex and multidimensional concept. According to the most common definition of creativity (Runco, 2012), it represents the ability to discover something new, to adapt one's available knowledge purposefully, and to solve the problems in an original, flexible and effective manner.

When we define creativity and innovation, it is essential to take into consideration the social, cultural and economic context in which we live. In fact, with human evolution, there are new domains in which creativity is often expressed, such as politics, digital technology, moral and everyday life (Runco, 2017) that require proposing new methodologies for its investigation (Williams, et al, 2016).

The digital evolution, for example, is having an important impact on creating and innovating, which involve a continuous movement across analog and digital, and across the real and the virtual. Being constantly immersed in an online reality (Floridi 2015), human beings have undergone critical cognitive, behavioural, and social changes. In the last decades, with the acceleration of emerging digital technologies, important influences have shaped the creative process, from the identification of a problem to the acquisition of knowledge till the generation of an innovative idea and its implementation. Also, the cognitive, motivational and environmental components involved in the creative thinking process are strongly impacted by ongoing changes. Indeed, the concept of creativity is constantly transforming in response to the socio-cultural environment around us (Runco, 2014), and its definitions have to evolve and fluctuate over time.

Today, most of the research and practices related to the creative process are concerned with human creativity, either how it is manifested in communities, organizations, or at a cognitive, individual level. Wilson (2017) defines creativity as a "unique and defining trait of our [human beings] species", where this trait is exclusively attributed to humans and make us search for "the innate quest for originality". Thus, creativity can be regarded as one of the central components of anthropocentric thought.

In the introduction, we described the transition process towards post-anthropocentric world, which is defined, at once, by digital and green transformations. There is a need to explore how each of these macro-processes will impact creative expression in the post-anthropocentric era.

First, there is the pervasiveness of emerging digital technologies, their accelerated evolution and the effects they produce on our reality. Thus, it is essential to understand how digital technologies are transforming creativity and how they affect the creative process of individuals or teams, thus, the impact on the practices and tools required to perform it. These circumstances create new hybrid configurations of living and artificial systems and undermine traditional models of cognition, action, expertise, learning and, consequently, creativity (Roudavski, 2016).

Second, moving away from the preconception that creativity is a sole human ability, how can we expand the definition of creativity to make it more inclusive and rethink the values and ethics involved in the process? Roudavski (2016) proposed to look at the post-anthropocentric creativity along two paths: (i) agents, recipients, and processes of creativity alongside its (ii) purpose, value, ethics and politics. According to Roudavski, non-human entities can be seen as creative agents, which will foster new sets of ethical values and purpose behind any given creative output.

Design has a unique revolutionary opportunity to provide methods and tools to guide our understanding of creativity for the future transition, and to empower people innovation potential. Future designers should support people and organizations in the green and digital transition, making them more conscious in the adoption of digital technologies for sustainable challenges, through creative empowerment. Designers are increasingly called upon to be facilitators of creative and collaborative processes, to generate innovation and support companies' digital transformations.

Today, more than ever, the human-centered design approach becomes a fundamental tool that should be expanded and integrated to meet post-anthropocentric complexity (Davidova and Zavoleas, 2020). What new skills, methods and approaches do we need today to design for the post-human world? What type of creativity?

In summary, it is essential to study the aspects that will impact creativity in the Post-Anthropocentric era in order to facilitate the creative processes in the best possible way and to increase the creative and innovation potential of people.

3. Creativity components in the post-anthropocentric scenario

In this section, we have identified the following aspects which will impact the creative design process for innovation in the post-anthropocentric world: 1) the rise of *digital technologies as a co-creator agent* that can augment human creativity, 2) *ecological intelligence* as a prerequisite for future regenerative creativity, and 3) the need of *anticipation of uncertainties* when designing and innovating for the future.

3.1 Digital technologies as an agent of creation

The democratization of digital technologies provided new opportunities for people to engage in creative activities, generate innovative digital ideas, and contribute to a distributed manifestation of the creation processes. Emerging digital technologies augment human ability to generate novel

ideas (Amabile 1988; Sternberg and Lubart 1999; Runco and Jaeger 2012) by acting as an active partner in the creative process. Companies and artists have already started to create their own digital interfaces to support creative process, as well as to propose tools that empower human potential by going beyond current human capabilities. Thus, humans and computers act as a team or a duo, supporting and shaping each other during the process. A digital agent can become a co-creator that speeds up and amplifies the stages of the creative process - it can help generate, evaluate, or refine ideas and bring them to culmination as full-fledged products. This co-creation process is the ambitious vision of human-techno interaction for creativity (Lubart, 2005).

The co-creation between humans and technologies can be implemented with the help of Creativity Support Tools (CST). These are the tools, user interfaces, socio-technical environments, and software that support creativity across domains, empowering users to be more productive and more innovative (Shneiderman, 2000, 2002, 2007). The goal of adopting digital technology is to make more people more creative more often, enabling them to face a variety of challenges creatively and successfully – e.g., more effective searching of intellectual resources, improved team collaboration, and accelerated creative discovery processes (Shneiderman et al. 2005).

Emerging cognitive technologies such as Machine Learning (ML) and Artificial Intelligence (AI) allow to engage in creative processes, as they can autonomously learn and interpret information, combine concepts to generate new ideas, or contribute new ideas in dialogue with humans. Other digital technologies, such as Virtual Reality (VR), can provide immersive realities based on imaginary, symbolic or real-world simulations by altering the surrounding space and objects (Fuchs and Moreau 2006). They can be used to modify the space in which the creative activity take place, situating it within digitally created artificial worlds that can inspire the creator and activate curiosity, interest, and inspiration as ways to augment and diversify possibilities (Kadri, 2017).

Digital technology can be considered a divergent modifier designed to inspire and support people in divergent thinking. By replicating or enhancing human cognitive processes, such as analogic and metaphorical thinking, conceptual combination, lateral thinking, creative visualisation, the digital agent can speed up and enrich human thinking while augmenting work and learning processes (Bruno, 2022).

3.2 Re-birth of ecological intelligence

To respond to the devastating impacts of the Anthropocene, researchers and practitioners in different fields have started relating to nature as a source of inspiration for novel ideas with the help of planet-centric design, biomimicry and nature-based solutions. Bowers (2011) introduced the notion of ecological intelligence to rethink the human ways of relating to the environment and re-introduce its teaching in schools. Ecological intelligence is the capacity to adapt cultural and social practices to the limits and possibilities of a particular bioregion. Scientists have already started exploring the cycles of renewal and energy flows, and their impact on environmental and social justice systems. However, it is not yet a widely accepted approach across the disciplines, and as Bowers (2011) highlighted in the educational system in particular, we are failing to teach and exercise ecological intelligence to students and “thus to move to a post-industrial form of consciousness” (p. 21).

The autonomous individual and centred-self became very dominant in the political and social systems of the industrial countries characterized by oftentimes rational, abstract, and decontextualized thinking. The exclusive focus on humans in production and consumption has also extended to design research and practice, where human has traditionally been a central figure in the design process. Today, as we move towards a green and sustainable transition, we need to develop an environment-centred approach (Sznel, 2020) when approaching innovation and take

other species into account. Therefore, ecological intelligence has a chance to revive again and establish a new approach to connecting human and non-human worlds.

Fortunately, as it has been a long-lasting practice in our societies in the past, ecological intelligence is not something we have to invent anew. The current challenge is, however, to find ways to rediscover our embedded position as human beings within ecosystems and rethink practices, ethics and values which underpin our relation to non-human species. It will require an understanding of complex knowledge of local ecosystems – human and biological, as well as the moral and reciprocal values established between them.

3.3 Anticipating the impacts of digital innovation

The future is underpinned by uncertainty, complexity and wicked problems influenced by socio-economic, political and rapid technological changes. Futurists foresee that these processes will change the foundations of society as we know it. Companies, governments, institutions and society in general must be prepared to **face the multiplicity of uncertain futures, anticipate possible scenarios to guide innovation**, as well as **take full advantage of the innovation capacity of digital technologies**. The ability to anticipate future impacts in complex systems can enhance resilience of society and be prepared for future changes and threats.

Some disciplines have considered the opportunity to rethink their sciences from past-oriented to future-oriented. For instance, the American Psychological Association has proposed a paradigmatic change to psychology by making the future “a core organizing principle of the mind” and identifying the past as a resource from which humans draw when they envision future prospects (Scolozzi et al., 2017). In the same way, in anthropology, Appadurai (2013) proposed to rethink the definition of humans as future-makers who are characterized by the three human occupations that are shaping the future - imagination, anticipation, and aspiration.

Design must also respond to this increasing complexity of the future and develop the creative abilities needed to identify, monitor and navigate its impacts. Hines and Zindato (2016) explored the relationship between Design and Foresight and showed that two fields share an essential tool: scenarios. Moreover, they highlighted the fact that both disciplines are characterised by a core phase of generation followed by a "final phase of narration and representation" (Hines and Zindato, 2016). These similarities explain the significant relationship between Futures Thinking and Design which gave birth to new design approaches, for example Speculative Design and Design Futures (Paraboschi and Dalla Rosa, 2016; Dunne and Raby, 2013)

The post-anthropocentric scenario will require creativity to take the future as a core guiding principle and a source of inspiration by using a variety of old and new tools to navigate the complexity and uncertainty of today in producing responsible designs for a resilient world.

4. A new framework of creativity to innovate in the Post-Anthropocene

In the previous sections, we have identified some key characteristics of the post-anthropocentric world and their relation to creativity focusing on those aspects that are likely to impact creative design processes for innovation. To synthesize our arguments, a framework for post-anthropocentric creativity is introduced which can structure and guide the creative processes of the present and the future.

This framework consists of three dimensions: *Digital Creativity*, that considers the agents, recipients and processes of creativity where both human and digital technology are creative agents; *Regenerative Creativity*, that considers the assemblage of human audience and non-human strategic stakeholders underpinned by ecological intelligence, and *Futures Thinking*, that provides a strategic approach to balance the other two dimensions and a vision to shape the future in the post-Anthropocene era. Digital and Regenerative Creativity also need to be underpinned by a set of

renewed values and ethical principles. The framework adopts the metaphor of the lever, showing that balance can and must be achieved.

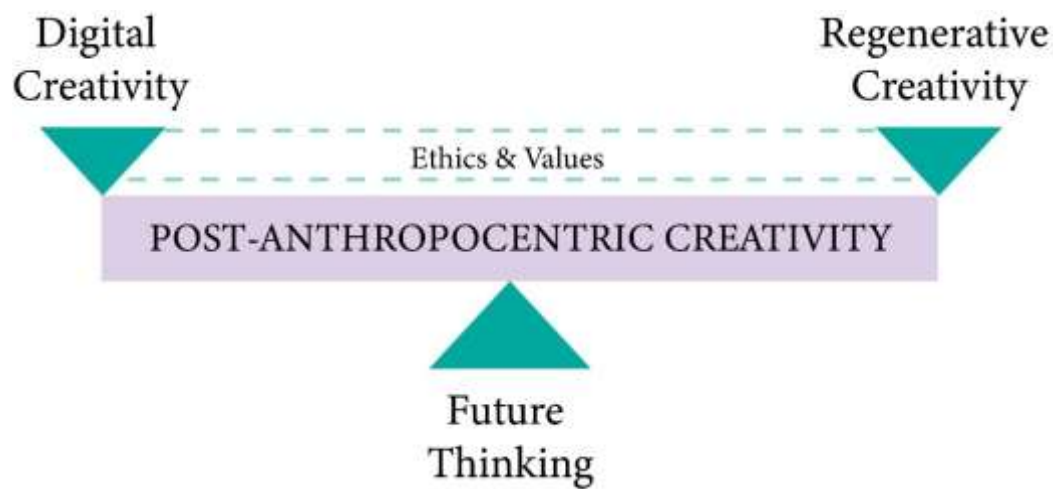


Fig. 1 – The three dimensions of the Post-anthropocentric creativity.

4.1 Digital creativity

In the context of digital evolution, creativity acquires a new shape: Digital Creativity, intended as the human ability to create an innovative and original digital outcome strategically exploiting the opportunity of digital technologies (Bruno, 2022). In the post-anthropocentric scenario, innovation will be generated by a symbiosis of human and digital actors that drive and impact each other. This symbiosis generates a double opposite perspective with which to approach Digital Creativity: one is related to the impact that human creativity has on digital development, and the second is related to the impact of digital technologies on the creative process.

We define the Digital Creativity perspective of the human agent in terms of *creativity-driven technologies* that encompass the human creative ability to shape technologies, exploring, modifying and guiding their development. It enables humans to mature towards the evolution of digital technologies which means, among others, adopting them to create more sustainable, responsible, and equal possibilities for the future. It means consciously driving technological evolution and empowering innovation through digital technology, putting technology at the service of human needs. This ability entails the understanding and application of a human-centred creative process designating the interdependence between a psychological process and a practice that takes place in the material world through a series of individual and/or social activities and leads to the production of original outcomes. The human minds today is intertwined with technologies and practices of communicating, remembering and planning. This symbiosis with technology, called "human-technology symbionts" (Clark, 2003), undermines the idea of the mind/body duality by making common functions such as communication, perception or memory dependent on various external devices.

We define the Digital Creativity perspective of the digital technology agent as *digitally supported creativity* that encompasses how digital technologies can support and enhance human creativity becoming a co-creator in the innovation process. The concept of Digital Creativity is intimately related to the idea of Digital Maturity, defined as a dynamic state that an organisation aims to achieve in order to improve the integration of digital technologies as support for human activities (Kane, 2017). Achieving Digital Maturity for the post-anthropocentric future means being able to

use the digital skills needed to engage not only with humans but also with other species and infrastructures.

Digital creativity requires people to have new skills, a new digital mindset, and a greater awareness of the actions they perform and their consequences for others and, as we shall discuss next, for the environment. A human agent should be able to strategically exploit the opportunities presented by digital technologies to create an innovative original digital outcome (Bruno, 2021) by putting them at the service of the community (Lee and Chen 2015) and environment. Individuals should also learn how to adopt emerging digital technologies to empower, enhance and stimulate their creative processes. This kind of dependence 'extends' the human into the world of distributed cognition and action. Interfacing with external devices can help us acknowledge that this context of human action has its own histories, tendencies and agencies, where human cognition and behaviour emerge as deeply collaborative, i.e., co-performed with non-human digital entities. Technologies characterized by pervasiveness, constant change, simultaneity of operations produce new cyborgian configurations of living and artificial organisms, and help to rethink existing notions of cognition, learning, expertise and creativity (Roudavski, 2016).

4.2 Regenerative creativity

Responding to the devastating impacts of climate change on our environmental and social systems, the transition to post-Anthropocene will demand a shift from degenerative to regenerative ways of living, creating, and innovating. Transition requires new design approaches informed by a different set of values, knowledge, and practices. There is also a need to redefine our human relationship with the environment. We propose a definition of *Regenerative Creativity* that embraces the well-being and justice aspects of environmental and social systems. Regenerative creativity as a creative process aims to produce those regenerative designs that can help us stay and flourish on this planet and engage in green and sustainable innovation. Regenerative creativity will be explored through the expansion of creative agents and processes from humans to non-humans, enforced by ecological intelligence.

Bruno Latour (1996) in his actor-network theory (ANT) has emphasized that both humans and non-humans hold agency and advocated for a deeper understanding of the relations between these assemblages. Agency is mostly driven by knowledge, which is traditionally seen as a human quality and as defined by human experience. Post-anthropocentrism rejects the idea that humans are the only ones capable of generating knowledge and allows for other forms, beings, and objects to be included in the knowledge production. Scholars working within post-humanistic studies try to redefine what and who has the capacity to produce knowledge and engage in the creative thinking process, where new materialisms and ecologies thrive (Ulmer, 2017). In this light, the post-anthropocentric period should not consider creativity merely as a human capacity, but rather treat it as an assemblage between human and non-human entities that produces hybrid knowledge and experiences. Ulmer (2017) points out that the knowledge frameworks that focus exclusively on the human perspective "could be viewed as incomplete", as well as demonstrate "potential injustice to non-human entities".

Thus, the question becomes: what are the mechanisms capable to activate different ways of knowing and other sources of knowledge beyond human-centred ones? How can creativity be fed and fostered by the new ways of knowing and imagining? It is certainly a challenge to account for non-human perceptions and include non-human entities in the creative process. As in the example of designing future cities, non-human perspectives and needs remain largely invisible in participatory design methods (Rice, 2017). However, nature as a non-human agent "can influence the imagination, too: our experience of or interactions with plants and animals, flooding rivers,

disappearing lakes, and rising oceans, soil, mountains and glaciers, weather, climate and seasons, volcanic eruptions, a starry night sky" (Milkoreit, 2017, p.5).

Regenerative creativity is inspired by the inclusion of non-human agents to ensure a just and sustainable transition. However, it also requires new methodologies to produce new forms of knowledge and engage in new forms of creativity. There is a need to expand the usual human-centered approach that focuses on collecting and generating knowledge through interviews, texts, observations, images, sounds, etc., and integrate it with knowledge and techniques from usability, ecology, and sustainability science. It is the role of design to move beyond human needs and human experience. Thus, regenerative creativity can help us develop and implement ecological forms of intelligence and thus move to a new form of consciousness and knowledge formation.

4.3 Futures Thinking as the element of balance

Developing a new approach to creativity is one of the most challenging tasks we are facing nowadays. It is difficult to expand our creative thinking to include non-human, living and non-living organisms ranging from biota to algorithms. In the same manner, Roudavski (2020) stresses that while post-anthropocentric cultures are desirable and likely to find their place in the world, the theoretical and practical developments they bring about still requires a lot of research. But where do we start from?

Designing for the future require a strategic and creative approach to critically explore future scenarios in order to rethink established beliefs and practices. Bell (1996) suggests that two of the nine purposes of futures studies are the use of creativity and imagination to generate possible futures and break away from conventional thinking. Thus, Futures Thinking is a methodology meant to explore and develop creativity for a post-anthropocentric context. Since technological advancements and innovations can modify and reshape social, environmental and economic dynamics, it becomes paramount for decision makers to increase their awareness on such implications and try to foresee, control and manage them efficiently in order to move strategically towards their preferred future (Bühning & Liedtka, 2018). Indeed, companies should find creative and original ways to respond to these ongoing technological transformations to succeed in the future. Therefore, Futures Thinking empowers us to think about alternative futures, it also helps provide companies, decision-makers, and designers with the capacity to proactively anticipate changes, recognise opportunities, envisioning medium or long term horizons and facilitate the transition towards more desirable futures. Besides, the acquisition of forward thinking and other Futures Thinking skills turns out to be essential to foresee possibilities and shape innovative strategies. Indeed, it allows not only to acknowledge changes in the long-term but also, and above all, to inform today's decision-making. Consequently, Futures Thinking (Saritas and Smith, 2011; Voros, 2003; Prosser and Basra, 2019) is a methodology that can provide the balance mentioned in the post-anthropocentric framework of creativity. As we proposed, both types of creativity, Digital and Regenerative, must be included in the creative process in order to make sure we are designing for a sustainable and just world. Even though both approaches are explored in design research, we still need to define the co-creation and symbiosis of human, biological and digital systems with their redefined ethics and values. Futures Thinking is an analytical and critical tool to understand the circumstances, future possibilities, and opportunities to "design for debate". It can methodologically push designers' creativity and prepare them to face complexity and multiplicity of futures.

Futures Thinking has to guide the development of a new way of thinking, where we (humans and non-humans) are seen as entangled symbiosis in which nothing is separated, and in which biological, technological and human ecosystems are in a constant exchange.

New methods need to be invented to study the symbiosis and hybridity of complex systems, and Futures Thinking methods can empower design methodologies that generate a more complete,

innovative and forward-looking approach to designing products and services for the future (Canina et al. 2021)

Futures Thinking does not only provide a better balance for Digital and Regenerative creativity, it is also informed by these components. They both inform Futures Thinking process by expanding the notion of “future” which has been dominated by the human perception of time. What if non-human (algorithmic and biological) time scales and perceptions are very different (slower, faster, or fractioned) from ours, and they can enrich and expand our approach to long-term thinking? We propose that both *Regenerative Creativity*, by tapping into new types of knowledge generated by humans and non-humans, and *Digital Creativity*, by enhancing creative process with the help of novel digital technologies, can help expand the fields of Futures Thinking and creativity to tackle the challenges of the future.

In the chapter, we particularly stressed the balance between two types of creativity – Digital and Regenerative – because we believe this balance should be observed in the design practice as well. As Fry (2011) mentioned, “We now exist in two kinds of intertwining ‘natures’: the biological and the technological”. At the same time as we are adapting to the ongoing digital transformation process and reaching digital maturity, we should also reconnect to the biological environment. As a result, there is the big challenge of reconsidering the role of human functions in relation to biological and algorithmic digital systems and the sharing imagination, creativity and power between them.

4.4 Ethics&Values: as transversal drivers

The concept of creativity oftentimes implies the process of imagination and the production of novel ideas. However, imagining and designing for the future are often a site of hegemonic discourses that can be serve as an instrument of power. There is a need to rethink the notion of imagination in order to ensure inclusivity of creative agency. But the expansion of inclusivity always implies rethinking established values and the new ethics specific for the inter-relationship between humans and non-humans (as both living and digital entities).

Several influential thinkers have already been discussing the expansion of rights to animals, bioregions, plants, and rivers. But do algorithms, software, AI also have rights? Do non-humans matter in the same way as humans? The role of human power and agency across the creative process must be rethought. Roudavski (2020) points out that our current social and political systems have been considering "non-human life to work as capital, commodities, services or labour". However, post-anthropocentric thinking requires a new understanding of justice that accounts equally for human, biological and digital systems - their interactions, behaviours and cultures. Ethical principles must be based on the concepts of co-creation and fair distribution, without any system taking over the dominant role. There is a need to move away from the anthropocentric bias, which still exists in re-emerging concepts, such as urban ecology. Urban ecology perceives urban space as an area where human beings co-exist with the living ecosystem. Nevertheless, humans are still being considered a focal point with non-human entities being subordinated to them. In order to develop a new system of values, we need to reconsider humans as part of a nature continuum. Ecological intelligence can help to rethink our belonging to nature and re-establish reciprocal relationship with it.

Regenerative and digital creativity can help to uncover things and processes that are marginalised and underrepresented. By extending human agency for creative work to other non-human beings, both digital and living, we can provide the field with an exploration of alternative values and knowledge. For instance, digital technologies, as a non-human entity itself, can interact with humans and non-human entities to produce new forms of knowledge to foster creative thinking process. In addition, as the creative process is responsible for innovation which, in turn, is what future generations and their well-being depend on (Krznaric, 2020), both types of creativity can help

to incorporate the notion of responsibility when developing a set of new principles for creative action. Thus, the creativity for post-anthropocentric future needs to stimulate symbiosis and connectedness based on the principles of mutual reciprocity, fairness and responsibility.

5. Conclusion

Today a new approach is required in order to develop the capacity to imagine innovative solutions for the numerous wicked environmental, social and economic problems specific for times of complexity and acceleration of the transition to a post-anthropocentric era. The Anthropocene has produced a dominant human-based and human-oriented legacy. Yet, the changing world of rapid digital transformation and environmental hazards forces us to find new ways to think, design and innovate. It is a responsibility of the design discipline, as a future-oriented field, to play an important role in translating the critical implications of this transition into alternative sources of knowledge and value systems. Otherwise, design could also act as a *defuturing force* if it is to serve and create for the established consumer system, which is inherently unsustainable (Fry, 2011).

In this chapter, we proposed the post-anthropocentric creativity framework in design which aims to ensure inclusive and just design processes, as well as enhance creative skills for all actants involved. The vision of the framework is to expand our vision towards experiences that are unknown to us as humans. We referred, in this context, to the notion of non-human as both other biological species and infrastructures, as well as digital technologies that humans interact with. Taking this perspective, creativity can and should enable a more-than-human perspective to challenge our conventional social practices and beliefs. A post-anthropocentric creativity framework can help equip the design field with the necessary tools and approaches required to design, collaboratively, for the future.

References

- Amabile, T. M. (2012). Componential Theory of Creativity. *Harvard Business School*, 1–10.
- Amabile, T. M. (1988) 'A Model of Creativity and Innovation in Organizations', *Research in Organizational Behavior*, pp. 123-167.
- Appadurai, A. (2013) *The Future as Cultural Fact—Essays on the Global Condition*. VersoBooks, London and New York
- Aslanova I.V., Kulichkina, A.I. (2020) 'Digital Maturity: Definition and Model' in *Advances in Economics, Business and Management Research*, Volume 138, pp. 443-446
- Bell, W., 1996. What do we mean by futures studies. In: Slaughter, R. (Ed.), *New Thinking for a New Millennium: The Knowledge Base of Futures Studies*, pp. 3–25 (Melbourne, Australia).
- Bowers, C. (2011) 'The Task Facing Educational Reformers: Making the Transition from Individual Intelligence to Ecological Intelligence', *Journal of Teaching and Learning*, 7(2).
- Bruno, C. (2022) 'Digital Creativity dimension: a new domain for creativity', in Bruno C., *Creativity in the Design Process. Exploring the Influences of the Digital Evolution*, Springer Series in Design and Innovation.
- Brown, T. (2009). *Change by Design. How Design Thinking Organizations transforms and inspires Innovation*. New York: Harper Collins Publishers.
- Canina, M. R. and Bruno, C. (2021, July) 'Digital Creative Abilities for Achieving Digital Maturity', in *International Conference on Applied Human Factors and Ergonomics* (pp. 27-35). Springer, Cham.
- Clark, A. (2003) 'Artificial intelligence and the many faces of reason', *The Blackwell guide to philosophy of mind*, 309-321.
- Cross, N. (2011). *Design Thinking: Understanding How Designers Think and Work*. Ber, Oxford
- Dunne, A., Raby, F. (2013). *Speculative everything: design, fiction, and social dreaming*. The MIT Press, Cambridge, Massachusetts

- European Commission (2019), Communication from the commission to the european parliament, the european council, the council, the european economic and social committee and the committee of the regions. The European Green Deal.
- Floridi, L. (2015), 'The onlife manifesto', Springer-Verlag GmbH.
- Fuchs, P., Moreau, G. (2006). *Traité de la réalité virtuelle*.
- Fry, T. (2011), *Design as Politics*. Berg, Oxford, New York.
- Hines, A. and Zindato, D. (2016) 'Designing Foresight and Foresighting Design: Opportunities for Learning and Collaboration via Scenarios' *World Future Review*, 8(4) 180–192.
- Latour, B. (1996) 'On actor-network theory: A few clarifications', *Soziale Welt*, 47(4), pp. 369–381.
- Lee, M. R., and Chen, T. T. (2015) 'Digital creativity: Research themes and framework', *Computers in Human Behavior*, 42, 12–19.
- Lubart, T. (2005). How can computers be partners in the creative process: Classification and commentary on the Special Issue. *International Journal of Human Computer Studies*, 63(4–5), 365–369.
- Kadri, A. (2007). Contribution de la réalité virtuelle à l'évaluation de produits, dans les phases amonts du processus de conception
- Kane, C.: Digital Maturity, Not Digital Transformation, MIT Sloan Management Review (2017). Retrieved from <https://sloanreview.mit.edu>. Last access: 11/02/2021
- Krznaric, R. (2020) 'The good ancestor: How to think long term in a short -term world'. WH Allen.
- Milkoreit, M. (2017) 'Imaginary politics: Climate change and making the future', *Elementa: Science of the Anthropocene* 5, 62.
- Paraboschi, A., Dalla Rosa, P. (2016) 'Design Futures: A New Discipline, Tool and Medium', *Digit. Sci. J. Digit. Cult.* 85–94
- Prosser, Z. & Basra, S. (2019). Futures Thinking: A Mind-set, not a Method. Embedding futures thinking within design practices. Touchpoint. The journal of service design. Medium.
<https://medium.com/touchpoint/futures-thinking-a-mind-set-not-a-method-64c9b5f9da37>
- Rice, L. (2017) 'Nonhumans in participatory design' *CoDesign* 14.
- Reeves, S., Goulden, M., Dingwall, R. (2016) 'The Future as a Design Problem' *Des. Issues*. 32, 6–17 (2016).
- Roudavski S. (2016) 'Field creativity and post-anthropocentrism' *Digital Creativity*, 27:1, 7-23, DOI: 10.1080/14626268.2016.1151443
- Roudavski S. and McCormack J. (2016) 'Post-anthropocentric creativity' *Digital Creativity*, 27:1, 3-6, DOI: 10.1080/14626268.2016.1151442
- Roudavski, S. (2020) 'Multispecies Cohabitation and Future Design' in Boess, S., Cheung, M. and Cain, R. (eds.), 'Synergy' DRS International Conference 2020, 11-14 August, Held online.
- Runco, M. A. (2017). Comments on Where the Creativity Research Has Been and Where Is It Going. *The Journal of Creative Behavior*, 51(4), 308-313.
- Runco, M. A., Jaeger, G. J.: The standard definition of creativity. *Creativity Research Journal* 24(1), 92-96 (2012).
- Saritas, O., Smith, J.E. (2011). The Big Picture – trends, drivers, wild cards, discontinuities and weak signals. *Futures*. 43, 292–312.
- Scolozzi, R., Gretter, A., Eccel, E., 2017. Anticipating (the) nature: The future in environmental science, introduction to the virtual special issue | Elsevier Enhanced Reader. *Science of the Total Environment* 609, 1566–1568.
- Shneiderman, B. (2007) 'Creativity support tools: Accelerating discovery and innovation' *Communications of the ACM* 50(12), 20-32.
- Shneiderman, B. (2002) 'Leonardo's Laptop: Human Needs and the New Computing Technologies' MIT Press, Cambridge, UK
- Shneiderman, B. (2000) 'Creating creativity: user interfaces for supporting innovation' *ACM Transactions on Computer-Human Interaction* 7(1), 114–138
- Shneiderman, B., Fischer, G., Czerwinski, M., Myers, B. (2005) 'Creativity Support Tools' National Science Foundation Workshop Report, 1–83.
- Sternberg, R. J., Lubart, T. I. (1999) 'The concept of creativity: Prospects and paradigms' In Sternberg R.J. (ed.), *Handbook of creativity*. Cambridge, New York, 3-15.

- Sznel, M. (2020). The time for Environment-Centered Design has come. *UX Collective. Medium*.
<https://vincenthofmann.com/principle/2021/03/26/principles-of-design.html>. Last access: 06/04/2022
- Ulmer, J., (2017) 'Posthumanism as research methodology: inquiry in the Anthropocene', in *International Journal of Qualitative Studies in Education*, 30(9), pp.832-848.
- Van der Bijl-Brouwer, M., & Dorst, K. (2017). Advancing the strategic impact of human-centred design. *Design Studies*, 53, 1–23.
- Voros, J. (2003). A generic foresight process framework. *Foresight*. 5, 10–21.
- Wilson, E O (2017), *The origins of creativity*. Penguin Books, Great Britain, p.3
- Williams, R., Runco, M.A., & Berlow, E. (2016). Mapping the themes, impact, and cohesion of creativity research over the last 25 years. *Creativity Research Journal*, 28, 385–394
- World Economic Forum: The Future of Jobs Report 2020. Geneva, Switzerland, October 2020 (2020)
Retrieved from <https://www.weforum.org/reports/the-future-of-jobs-report-2020>. Last access: 10/02/2021