



Developing a Method for Understanding How to Empower Creativity Through Digital Technologies: The Case of AI

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Abstract. The paper presents a method aimed at empowering human creativity to generate innovation by exploiting the opportunities and potentialities of the emerging digital technologies. The method, through the application of a Creativity 4.0 Model and Framework, aims at observing and understanding the impacts of a specific digital technology on the main dimensions of the human being, understanding how those impacts could positively or negatively influence the creative design process. The human centred method, currently in its early stage of theoretical development, aims to benefit design research, education and practice supporting them in understanding the ongoing human transformation and in making a wiser and consciously use of digital opportunities addressed to human creative enhancement for innovation.

Keywords: Digital maturity · Creative process · Artificial intelligence · Design method · Human centred

1 Introduction

This specific phase of technological progress seems to be very different from all the preceding ones: it involves a combination of transformative and cognitive digital technologies, tools and processes and most importantly people, in terms of culture, skills and mindset [1]. Therefore, the interconnection between technology, human cognition and human life in general will become much more intrinsic, invisible, and impactful. The human being is co-evolving with digital technology [2] as it modifies our “relationships to ourselves (who we are), the interaction with others (how we socialize), our conception and interaction to the real world” [3]. A digitally enhanced generation is growing up accepting digital enhancement an integral part of everyday lives [4].

In this digital era, a fundamental and pressing concern address the role of humans in this abundance of new, smart and very efficient technologies, which progress and evolution cannot be stopped and or even slowed down.

Humans are transforming the society through machines and technologies, and they must learn how to live well with them, and how to manage a radical change that will occur in less than a generation without suffering them. This means, reaching a **digital**

maturity defined as a “continuous and ongoing process of adaptation to a changing digital landscape” [5].

Reaching a digital maturity allow to continuously understand and possibly anticipate the foreseeable opportunities as well as the threats that will be offered by the technological evolution, developing a strategic approach to the adoption and application of such technology. It is therefore necessary to put human creativity at the center of the digital transition which has been recognized as one of the most distinctive human skills to nurture and develop in order to manage at best the powerful collaboration between human and machine. Indeed, creativity helps people conceive novel and useful ideas [6], representing the intangible substrate for innovation [7] and is, therefore, a key to economic growth and social transformation [8].

Human existence will be related one-to-one with our ability to generate ideas to successfully exploit the opportunities that technology is offering us. Hence the responsibility of studying, understanding and developing creativity skills, and defining how digital technology and human evolution influence those abilities and how to exploit the new opportunities to digitally enhance them, becomes a sort of multidisciplinary mission.

In this scenario facilitate and guide the creative process of every human being become, therefore, a mission and a new professional role for designers that will play a leading role in the process of people transformation toward digital maturity.

Therefore, as design researchers, our main contribution in this scenario of transition is the definition of a Human-Centred Method aimed at empowering creativity to generate innovation by exploiting the opportunities and potentialities of the emerging digital technologies.

We think that the design discipline should therefore prepare the next digital generation of designers and providing new creativity-driven design tools that will form the future designer toolbox for digital maturity.

Therefore, the method aims to benefit design research, education and practice supporting them in understanding the ongoing human transformation and in making a wiser and consciously use of digital opportunities addressed to human creative enhancement for innovation.

2 Building the Method’s Tools

The Creativity 4.0 method has been structure throughout a three years long research projects whose main objective was to explore the main positive and negative influences brought by the digital transition oh human creativity within the design process.

The research project main results were the definition of what have been called The Creativity 4.0 Model and Framework which supported the exploration of the influences on human creativity and their relationship with the design process, becoming therefore the two conceptual tools of the method.

The two tools are briefly described in the consequent sub-sections and have been developed and validated through several phases, the first of which was to identify and select, among the broad psychology literature in creativity, the approach through which deal with the creativity domain in this research.

Given the complexity and the multitude of approaches that can be adopted to study and explore creativity [9] it was essential to frame a clear definition and above all to choose which aspects to consider.

Drawing on the 7 C's creativity framework [10], the research aimed at investigating creativity by studying the integration and interconnection of three of its different facets which are:

- **creator**, referring to the digitally enhanced generation, the research adopts an individual perspective, considering the cognitive, personality, motivational and emotional factors of the actors that engage in creative activities. Those factors have been called factors of creativity;
- **creating**, referring to Stage and Componential Process theories [7] that study the creative process from the macro perspective as a form of activity or action;
- **context**, referring to the actual scenario of digital transition that influences several aspects of the human being.

Therefore, I adopted a more extended and elaborated definition of creativity [11] which claim: "Creativity is the interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel and useful as defined within a social context" (p. 90).

The identification of the three aspect of creativity, allowed to frame the creativity boundaries and build the frame of reference for the analyses of the impacts brought by the digital age which is represented by the Creativity 4.0 model.

2.1 The Creativity 4.0 Model

The Creativity 4.0 Model (Fig. 1) [12] is structured through three main elements: the *digital transition*, that is the ground on which the model is growing and feeding; the *human being* analysed according to the three levels on which the digital transition has an impact (cognitive, individual, social) and, finally, the *creative process*, namely human ability, which is transversal to all levels of the human-being.

These three elements also correspond to the three aspects of the 7 C's creativity framework on which the research is settled – context, creators and creating.

The Creativity 4.0 model built enables to include the many dimensions and factors of creativity identified that intervene within the human-being on the three different levels, which include **creativity as a mental process**, **creativity as an individual practice**, and **creativity as a social process** that unfolds with others.

The intersection of those three levels provides a comprehensive understanding of the complexity and multifarious aspects of the creative process comprising several steps, activities as well as the motivational, cognitive, attitudinal, technical constituents and the social and environmental components influencing these constituents during the process. The three levels also influence each other as they are part of the same person.

The Creativity 4.0 model is not static, but it represents a tool that allows to observe the impacts of the digital transition on the three levels of the human-being understanding how they influence the creativity factors. The model has been validated and

refined through three main exploration which allowed on one side to keep only the factors of creativity that are considered more relevant in this digital age, and on the other side, to collect a set of influences brought by the digital transition on the human creative abilities. For design research and practice, this analysis becomes strategic if it is structured within a theoretical framework that associates the impact identified and the influenced factors with the design process. Therefore, a Creativity 4.0 Framework has been built within the research, representing the second tool of the method.

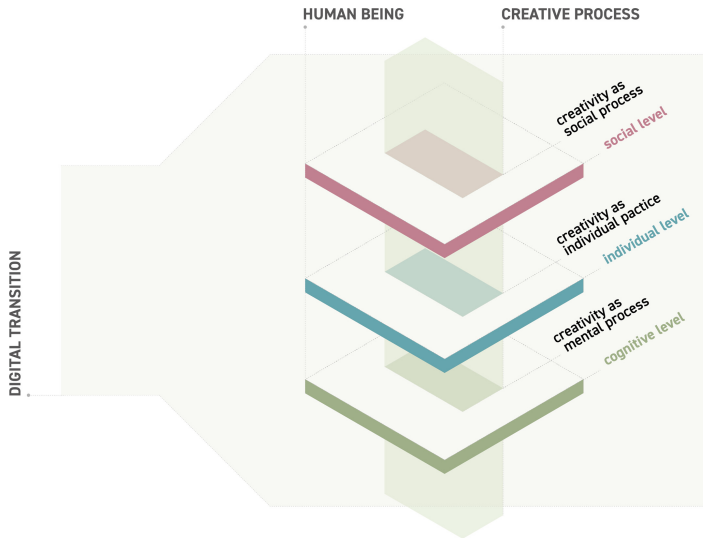


Fig. 1. Creativity 4.0 model

2.2 The Creativity 4.0 Framework

The Creativity 4.0 Framework [13] has been developed to properly understand how the digital transition is influencing the cognitive, emotional and social factors of the digitally enhanced generation that intervene in the design process that lead to the production of new, original and useful ideas.

By **deconstructing the design process in stages, steps, activities and thinking style**, the framework allowed to map the less rationale creativity factors emphasizing their interconnections and showing how the impacts of the digital transition, identified through the model, are influencing the activities, the creative factors and the overall design process.

The Creativity 4.0 Framework represent a tool to analyze the influence of the digital transition on the multiple aspects of the design process as well as to define design actions and tools to empower it.

3 The Creativity 4.0 Method

The Human-Centred Design method has the main aim of exploring the changes and opportunities of the digital evolution for augmenting human creativity, empowering the design processes for innovation in different context of application, putting people at the centre of the change.

The method aims to **facilitate and support the emotional, motivational, cognitive and social factors of the human being that intervene in the creative design process as well as the process itself**. These factors are the levers to be activated and enhanced to allow the human being to express his maximum creative potential.

The Creativity 4.0 method is structured according to four main steps where the model and the framework become operational tool that guide each step as follow:

Step1_Observe: the Model, in its static version, guide in the observation of the impacts that could affect the human being as well as in the observation of how technologies can support the creative process.

Step 2_Understand: the Model in its dynamic version, allow to understand how the impacts identified as well as the technologies observed, could influence the creativity factors and therefore the human creative abilities.

Step 3_Map: in this step, the Framework become the guiding tool. It allows to see the effects on the design process and to define action to empower creativity through the design process.

Step 4_Design: this represents the active step in which the identified and defined action is designed and implemented. It may refer to new tools, processes, activities to enhance single steps or the whole creative design process.

The Model and the Framework represent the fundamental knowledge needed to design actions to empower creativity abilities in in the digital age, exploiting the opportunities provided by the digital transition and the digital technologies.

In the next sub-section, we envisage the application of the method to explore the influences of a specific digital technology, Artificial Intelligence (AI), on creativity within the design process. This approach has been called **Technology-driven** since is based on the application and experimentation of the potentialities of a certain technology as a powerful source of competitive advantage.

3.1 Application of the Method on Artificial Intelligence

Step 1_Observe: in this step is fundamental to study the potentialities of AI and observe how it can support the creative process. This understanding can be reached by collecting researches projects, cases best practice that uses AI to enhance the creative process in its positive and negative aspects. For example, from a deep investigation of the literature, emerges that AI can be used as a co-creator within the creative process, supporting humans in fastening and amplifying activities and tasks in specific moment of the process. AI can also be used as a feeding partner, able of reproducing human cognitive processed to feed human thinking with inspiring divergent information.

Step 2_Understand: in this step is fundamental to analyze the cases with the lens of the factors of creativity trying to understand in which part of the process AI can perform its best as partner. One of the main recognized potentialities, as co-creator, is that it helps to accelerates research and discovery by freeing people from repetitive tasks, empowering teams to focus on more creative, higher-value work. Since its declared function in accelerating discovery and research, one of the opportunities identified is that AI could support in *Augmenting and speeding up human in exploring information and knowledge*. Therefore, the Explorative stage of the process could be its chance.

Step 3_Map: in this step is fundamental to relate the opportunity identified with the framework to identify which steps or activities within the process can be influenced by the adoption of AI as a co-creator partner to augment and speeding up in the exploration of information and knowledge.

It emerges that AI can have a fundamental role in managing a huge amount of data and information, by analyzing and interpreting them. The computational technology can support human to expand their initial information, speed up the analysis of large amounts of information, identify and make associations through information from different context of exploration and quickly identify both expected and unexpected findings. In this case the human partner will have the important role of analyze the result provided by the machine, generate hypothesis and identify novel directions. An important reflection emerges regarding the changing role of the designer that become the facilitator of the process and the designer of the process that allows the machine to contribute and co-create.

Step 4_Design: from this analysis, an hypothesis of action that goes in the direction of empowering creativity emerge, addressing the design practice.

From the analysis emerge that the system could supported the designers in the earlier steps of exploration and interpretation of the information. Indeed, during the process, the cognitive system become knowledgeable, as an expert, on the specific topic. By reproducing the learning and synthesis processes of a human being, it amplifies and extend the human cognitive potential providing meaning and insight out of a vast mass of unstructured data and information (i.e. specific information about materials, forms and design elements to be transferred in the final product) which would have taken a great deal of time to be done by human. Moreover, AI can discover unusual details that helped shape the designer creative vision.

Therefore, for the design practice, it could be interesting to develop a design tool based on AI, Natural Language and Visual Recognition tools, that acting as co-creator could analyze and clusters all the information that a designer collects on a specific domain and the information on the field such as research notes, interview transcripts, inspirational images and so forth, to speed up the explorative phases of the design process and to support the designers in extracting meaning and insights out of that vast mass of information facilitating the generation of alternative hypothesis and its strategic thinking.

4 Discussion and Further Development

The paper presented a method developed to deeply understand the main positive and negative influences that the current scenario of digital transition is bringing to multiple levels of human creativity to inform and design actions to empower the creative design process for innovation.

The method can be used for:

- Enhancing the activities and steps of the design process by experiment, implement and adopt the new emerging digital technologies in a conscious way, in order to strengthen human factors within the creative process of individual and/or collaborative design aimed at innovation. This could result in the development of creativity support tools to inspire cognitive processes, to speed up design activities or that can augment human physical and cognitive capabilities.
- Defining and strategically apply new processes for designing with specific digital technologies. This allow to consciously drive the technological evolution putting technology at the service of human needs.
- Empowering and strengthening the comprehension of the overall design process and the mechanisms behind the creative expression by developing training module for creativity that can fit and adapt to the new habits of the digitally enhanced generation.

The method has been theoretically validated by applying it to explore in a structured way the knowledge produced in the emerging domain named “Digital Creativity”, which is a wide and rapidly evolving realm, where multiple disciplines – psychology, sociology, computer science, HCI, etc. – already investigate the influence of and relationship between creativity and digital technology from several and fragmented perspectives. A total of 17 influences and their positive and negative influences on some factors of creativity have been identified and mapped on the creative design process, highlighting opportunities and threats brought by the digital transition.

At this point of the research the method needs an implementation and evaluation based on practical researches and the development of guidelines that allows everyone to put the method in practice.

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