This issue of the **diid** opens reflections on the current relationship between Design and Science. It aims to observe whether Design, leaving its consolidated areas, leans to denaturalize itself and lose its disciplinary skills or if, rather, it leans to acquire new ones by investing in the dialogue with Science not only the technological skills, but also the germinating ones from the relationship with Biology, Chemistry, Medicine, etc.
The open dialogue between Design and Science seems to prefigure a new sphere of knowledge which, alongside that of humanistic and scientific culture, today offers interesting spaces for action and interaction: real experimental laboratories, see the white coats of scientists in contact with the designer work overalls. So, scientists discover the envisioning ability of design, designers, for their part, change their approach by becoming "homo faber" and manipulators not only of matter, but also of living organisms.

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Medical simulation in 2025

In complex design contexts, which require horizontal management of vertical knowledge, design is taking on roles increasingly distant from those that originally distinguished it. Strategic visions and methodologies conceive the figure of the designer as a mediator between actors and knowledge coming from very distant areas, with great difficulties in communication and in being able to complete a project satisfactorily; and as a catalyst for the processes around innovation. Similarly, the speculative design methodology underlines the importance of the design of users, artifacts and futuristic scenarios, starting from phenomena and innovations taking place in the present, with the aim of generating critical thinking about the issues addressed. This paper was born from a first research, contextualized to the present, which had as its central theme, the development of guidelines for the creation of tools and environments useful for improving the simulation techniques used to provide training dedicated to the rescue teams that act in contexts of medical urgency. Having defined the design direction to follow in the aforementioned research, it is interesting to go for a visioning operation, which has medical simulation as its central topic, projecting it in the near future (2025), where the scientific progress related to certain disciplines allows to hypothesize a remarkable innovation in the system already proposed.

[speculative design, visioning, medical simulation, neuroscience, mixed reality]

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Introduction

Starting from previous studies and research (Volontè et al., 2017; Ianniello et al., 2019), the following discussion will define a new standard for medical simulation, contextualizing the reference scenario in the near future, carrying out a visioning operation.
The medical simulation of 2025 will allow total experiential and sensorial immersion. This will be possible thanks to studies in progress to date: relating to haptic perception (1), which will, therefore, allow returning tactile feedback, still not perfectly achieved with the instruments currently available; neuroscientific studies and the creation of neurodevices that will allow people to actively interact with interfaces and intelligent machines (2), generating dynamic simulations, modifiable in real-time by the person supervising the training, and therefore highly useful for training problem-solving skills. Most likely any form of analog tool will disappear, as can be the dummies (3), replaced by purely digital elements.
A fundamental point will be the accessibility to simulation, which will become the indispensable tool for training in all medical fields: if the tools used will be available for a large number of people, progress in managing emergency situations will be global and very fast.
Another main objective will be the creation of a normative, a code of conduct that doctors and all operators will have to follow in order to be highly efficient; this will be possible by mapping those who simulate and crossing the data obtained, in order to identify the correct positions, movements and actions to be performed, depending on the situation in which the teams are.

Speculative design

The practice of building future scenarios has a rich history of integrating models and methodologies belonging to different disciplines, to explore, project and describe possible futures (Kelliher & Byrne, 2015). The last decade has seen an emerging interest in theoretical, contextual and practice-based plurality (Schultz et al., 2012), while the simultaneous growth of forecasting practices to accommodate materials, methods and approaches from design and the arts (Candy, 2010; Davies & Sarpong, 2013) has returned an enrichment of the procedural and representation framework for emergent futures. By embodying this development, prototypes, design fiction films, alternate reality games and speculative design artifacts serve to incorporate futures thinking into the material world and in relation to everyday experience (Dunne & Raby, 2013; Kirby, 2010). Among the tools that are used by speculative design there are the scenarios, built starting from mega-trends, in place in the present, which can significantly change the future of life on the planet; P.E.T. factors (People, Environment, Technology), variables related to the social, environmental and technological sphere that can influence the development of global trends; finally the personas, who represent futuristic lifestyles, obtained by mixing characteristics of the aforementioned through matrixes and generating polar maps that describe users of the future.

Contextualization

Projecting in 2025, and referring to mega-trends, or global mega-trends (4) (5) (National Intelligence Council, 2012), one of the possible future scenarios is represented by a strongly connected world, thanks to innovations that will generate the first examples of meta-intelligences (i.e. admixtures of human and artificial intelligence, thus permeating the personal sphere of the individual human being).

The scenario of co-creative practices that are able to make user involvement and participation during the design phases flourish, favoring horizontal creation processes (Sanders & Stappers, 2014), has been identified to better point out the characteristics that the simulation, the network created around it and the stakeholders will have to assume: accessibility, sharing and collaboration.

P.E.T. factors taken into consideration concern attitudes of collaboration and sharing on a large scale, a mixture of innovations and democratization of knowledge and the creation of inclusive value chains.

The first two are dictated by the typology of background problems treated and by the methodology to face them; in the second category are the scientific area, selected with a wide range, and the economic medium, driving the new society; finally, speaking of social production and co-creation, it is logical that the choice falls on the selected factor, based on collaborative networks.

Scientific contamination

The mixed reality is undergoing a strong development and implementation, with major investments by IT and technology companies. This suggests that well before 2025, given the exponential innovation curve, it could become the universal tool for simulation, given its great versatility. It will, therefore, become more usable, less invasive and more efficient than today's solutions. Neurosciences are disciplines that deal with conducting studies on the nervous system.

In particular, the most interesting areas for the project addressed are systemic neuroscience (6) (Felten et al., 2015), which investigate the anatomical and physiological functioning of neural systems, in order to understand the behavioral and sensory sphere; and, to a lesser extent, cognitive neuroscience (7).

Various studies are underway, aiming at understanding aspects such as perceptual integration, and how it can be influenced by external stimulations (Stonkus et al., 2016); the generation of somatosensory feedback obtained in paraplegic patients, thanks to haptic devices, which allow the perception of the soil and virtual limbs (Shokur et al., 2016); the creation of visual feedback in blind patients, through sound and tactile patterns (Stiles & Shimojo, 2015).

These are some examples of the progress that is taking place in the field of neuroscience and which opens up very interesting and innovative design ideas in the field of medical simulation. If we move from the theoretical, research and academic field, there are neurodevices on the market, such as "Epoch" and "Insight", produced by Emotiv (8), which allow the user to monitor the brain activity in real-time according to some parameters; to mentally control physical and virtual objects, making them move in real and virtual space; to carry out market surveys focused on personalization and user experience. Another very interesting tool is "Hiro III" (Endo et al., 2011), a touch screen system, consisting of a robotic arm, which is able to simulate the touch of virtual objects, receiving feedback. The touch-screen uses a 3D display to generate the visual stimulus, while the physical hand is connected to the robotic hand, which returns texture, size and weight. A trick to make the experience more realistic is the insertion, within the 3D scene, of the model of the user's hand in the same position.

Observing the opportunities given by these worlds and knowledges, and projecting them to a ten-year development, it is clear that the visionary scenario that is opened up turns out to be a totally immersive simulated experience, both from a sensorial point of view and from a mental and emotional one; it will be dynamic and therefore real, thinking about the neural devices that allow the users to imagine simulated scenarios that change in real-time, based on the variables that will also influence the actual rescue operations.

Network

The implementations offered by these innovative sectors, combined with a new socio-economic context and constantly changing consumption models, allow us to hypothesize the development of a network of medical simulation (Ianniello et al., 2019), which involves different types of actors, which belong to the medical area, the design area, the innovation area and, finally, the government area.

Simulation centers and university and research centers will represent the prosumer (9) in a co-creation scenario, contributing to the project with their professional experience. In the innovative area fall the actors who will provide the knowledge necessary for design development, coming from the world of systemic and cognitive neuroscience. Government institutions will represent the indirect clients of the project and those who should invest capital for the development of the concept. Finally, design must assume the role of activator of the innovation processes and facilitator of co-creation activities.

Manzini denotes the great importance of involving different actors, stating that the role of the designer is to make things happen (2015). In the literature concerning innovation driven by design, the importance of the involvement of different stakeholders within the project is reaffirmed. Some conclude that the main discriminator of the success of this methodology lies in the co-development model, which involves various stakeholders during the design phases, facilitated by designers (Bailey et al., 2018).

Some authors promote the involvement of external stakeholders in order to fuel disruptive innovation (Norman & Verganti, 2014).

In the sector literature, it is repeatedly stressed that the value of design is fundamental for innovating sectors other than the reference one: Martin (2009), Yee and other authors (2017), present cases of companies and organizations that have been able to use methodologies taken from design to innovate their business value.

The keywords of the network will be accessibility, cooperation and sharing. Accessibility, in general, to simulated training, because the greater the centers involved, the more effective the rescue service provided will be; accessibility also with reference to the possibility of using the system, wherever users are, thanks to the implementations that will allow connections similar to the ones happening in the neural networks, between the centers who use the designed simulation system. Cooperation between the various stakeholders, so as to make the horizontal processes fluidly triggered, dynamic and constantly evolving.
Sharing of the results obtained, to standardize and equalize, and therefore improve the rescue actions, in order to train professionals who will be able to be efficient in as many contexts as possible. In this way, progressive improvement of the simulated training techniques will be possible: sharing the results obtained in the various sessions will allow a global comparison on the practices to be followed and the regulations to be drawn up, and the guidelines to be followed in any context in which rescues will take place.

Concept

The mission will be the excellent training of rescue teams, through increasingly advanced simulation techniques, and the constant updating of action protocols, through collaboration between the network actors and the sharing of useful data. An essential point will be to allow the simulation to any structures used for medical training, whether it is a hospital, a university, or a sort of traveling simulations, and, more generally, to any sector in which it may be necessary to resort to simulation techniques, both for training and for other purposes, obviously in line with ethical and moral principles.
The vision will be a totally immersive simulation experience, which will recreate the physical and mental conditions of the real experiences, involving all the user's senses. A simulation accessible to anyone will need to use this type of methodology, in an easy way in any context.
Going into detail of the concept conceived, it essentially consists of two different tools for interacting with the simulated elements; one dedicated to those who will carry out the simulation, another one for those who will supervise and manage it; and a device to generate the mixed reality, which must be transportable, in order to bring the simulation in as many environments as possible. The first object consists of two lenses, which will act as an interface between the mixed reality and the subject and will be active, managing to see what happens during the simulation and to feel the simulated elements, sending stimuli to an apparatus of miniaturized actuators on the body user. In this way he/she will be equipped with a sensory system dedicated to simulated reality, connected to the body itself and, therefore, in communication with it, through an artificial neural network.
The device designed for the trainers is a neurotool that will allow the user to dynamically modify the simulation, in order to make it more truthful, managing to recreate the evolution of a rescue operation, and to increase the level of difficulty for the simulators, inserting always different variables. It will also be able to collect and process sensitive data and to generate action protocols, based on the results obtained during the various simulations. The ergonomic and fruition improvements made, attributable to a highly immersive and adherent to reality experience, are understandable through the choice of using a set of non-invasive and much more functional tools. The development of a global and shared network of medical simulation could represent an important improvement for safety management, at least in the matter of interest, no longer fragmented and not univocal, but discussed, accepted and followed, in a global communion of intent.

Conclusions

The evolution and innovations are absolutely positive factors for the correct progress of the society, and therefore they are developed, in their first phases, in highly specific sectors, before going established and spread. The project addressed falls within these cases: the application is designed for the medical field, with a highly positive and functional purpose, which could allow this development to find possible applications in different fields. Unfortunately, once an innovation develops and spreads globally, the uses can be manifold, and could also include highly improper ones. The more disruptive the innovation is, the more serious the negative implication can be: by addressing issues related to neuroscience is fundamental to try to design also with an aim in limiting the possibility of improper uses. Going to design in such a specific context even if data collection operations are carried out, they are so peculiar and linked to the specific scenario, that they do not arouse ethical questions about this operation; however, if, as hypothesized on several occasions, the tool designed can be used in different sectors, the question about Big Data can become a topic of relevance to be addressed. There is absolutely no denying the enormous usefulness that massive data collection can have, as it can significantly improve different aspects of daily, social and economic life; however, precisely because huge quantities of data are processed and are accessible and usable by many subjects, it is necessary that the operations that can be performed on them are regulated by institutions.
There must also be structures capable of managing the acquisition, scanning and interpretation of these data, which must ensure the protection of the privacy of the people involved.
The visioning work, the design of the training system in 2025, is an increasingly necessary design operation, if someone wants to be able to achieve outputs that are truly valid, innovative and, therefore, long-lasting. Although there is awareness that the project can speak a futuristic language, it must be borne in mind that what is written, both from a scientific and a socio-economic point of view, is the result of an in-depth research and collection of sensitive data, reworked and interpreted together with a series of factors, highlighted in sociological studies and market dynamics. Secondly, it is necessary to understand the essential nature of such a process: a

founding brick of a design methodology, which tries to evaluate the present to solve typical and today's problems, and to anticipate needs and processes that can manifest themselves in a longer period of time.

[1] Haptic perception is the process of recognizing objects through touch. It derives from the combination of the tactile perception given by the objects on the surface of the skin and the proprioception that derives from the position of the hand with respect to the object.

[2] Artificial intelligence (AI) is a discipline that studies whether and how the most complex mental processes can be reproduced through the use of a computer. This research develops along two complementary paths: on the one hand, the AI tries to bring the functioning of computers closer to the capabilities of human intelligence; on the other, it uses computer simulations to make assumptions about the mechanisms used by the human mind.

[3] Mannequins are simulators used for different training methods in the medical field. They are capable of reproducing numerous physiological behaviors and reactions of the human body. The most performing are equipped with software to modify certain vital parameters and reactions, based on the type of scenario that will be simulated.

[4] See: https://www.quantumrun.com [Accessed 12 January 2019].

[5] See: https://www.oecd.org [Accessed 12 January 2019].

[6] The branches of neuroscience that study the functions of circuits and neural systems.

[7] A branch of neuroscience that studies the brain bases of thought, and allows to highlight the changes in the brain associated with the main evolutionary turning points.

[8] See: https://www.emotiv.com [Accessed 12 January 2019].

[9] An expression coined by Alvin Toffler in the book "The third wave" (1980): it is a crasis of the terms "producer" and "consumer" that indicates a consumer who is himself a producer or, in the very act of consumption, contributes to production.

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