Chapter 5
Toward a New Humanism of Technological Innovation in Design of the Built Environment

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Abstract This paper offers a reflection on the dialectical relationship between technological innovation and the culture of design for the built environment, hypothesizing a scenario in which the outdated interpretation of the merely instrumental role of technology may be plausibly recognized and overcome. Because it is increasingly complex, sophisticated, and pervasive in the life of and in the space inhabited by people, technology requires a renewed, humanistic approach in order to be governed, selected, and used, for the purpose of improving people's fragile living conditions on the planet. On the other hand, people are, in and of themselves, characterized by continuous exploration and invention to extend their abilities through technique, and given the uncertain future facing us, technique will once again be our friend, renewing a relationship that may be called one of *philotechny* rather than of pure fideism—or of anachronistic antagonism—toward technique. Although starting from a specific, low level of technology, the construction sector is absorbing the extraordinary, accelerated advances of the technologies belonging to the digital sphere; this may help guide the construction industry toward a new form of production, and at the same time, it may transform the designer's tasks, roles, and responsibilities. The designer of the future that faces us will have to be able to operate collaboratively within a system of vast competences, which will be mediated by the potency and accessibility of new tools and methods belonging to the digital technologies.

Keywords Building Intelligent Modeling · DT · Integrated Design · Architectural Technology · Technological culture of design

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5.1 Foreword. New Technologies as the Artificial Limbs of Contemporary People

Different conditions and types of "technopoly" have gradually succeeded one another, being transformed following the industrial and scientific revolutions of modern society; first came society's fideism toward machines, followed by the exceptional effects on modern society of electronics and computing (1920–1945), until the IT revolution that we are still immersed in, in a fully post-modern society vacillating between fideism toward the techno-sciences and oscillating awareness of the world's fragility.

The time we are living through appears dominated by uncertainty, even though unceasing innovation of technique is, more and more intrusively, offering the promise of guiding and controlling our decisions. Increasingly available enabling technologies, and the possibilities offered by computing to acquire and select an immense quantity of data, are yet another potent field of technical/scientific research at the service of the market economy. And yet, this does not at all appear to offer a ground for stable forecasts so much, instead, as to underscore the context of uncertainty we live in. In fact, this condition has of late been, in the fields of both the arts and the sciences, the object of recent shows and major exhibitions, such as 2021's "Tre stazioni per Art-Science. Incertezza. Interpretare il presente, prevedere il futuro" ("Three Stations for Art/Science. Uncertainty. Interpreting the Present, Foreseeing the Future.") at Rome's Palazzo delle Esposizioni and at the Spanish Pavilion, under the title "Uncertainty," at the 17th International Architecture Exhibition, Biennale di Venezia, 2021.

At the height of the crisis of modernity, authoritative scholars were already observing that the technologies with which people are surrounded are not mere "means." Referring to the "devices" of the second industrial revolution, the philosopher Gunther Anders wrote "because the 'means' is by essence something secondary. (…) introduced ex post facto for the purpose of 'mediating' that end. They are not 'means' but preliminary decisions that are made for us before we are called upon to decide" (Anders 1980. p.13.). The cited example is one of many relating to the controversial relationship, starting from the modern age, between man and machine, people, and technologies (Fig. 5.1).

Philosophical thought, traditionally distrustful if not hostile to technical/scientific thought, has recently raised positions of dialectics more open to the role and the pervasiveness of technique in our society. The philosopher Emanuele Severino has recurringly raised a series of questions on the growing domination of technique, and its limits in Western, capitalist society.

It has been noted that over the past forty years, the conception by which technique might be of use for cultural progress has been transformed; consider the economic/productive dominion of American technical universities, defining a sort of shared marriage between science/technique/production and the market. On the one hand, a convergence with respect to what technological evolution represents in our society and particularly as relates to architectures and to the built environment

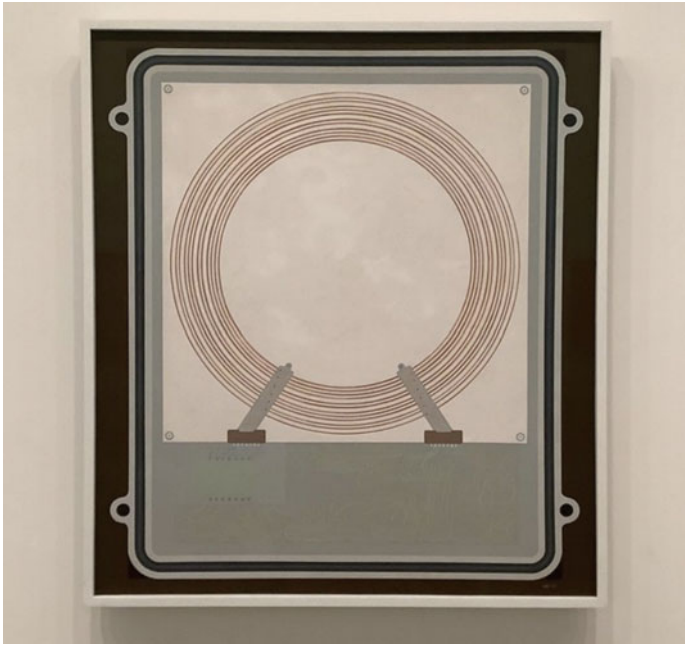

Fig. 5.1 Ulla wiggen, Cybernetic Serendipity, 1967. Biennale Arte 2022, milk of dreams. *Photo* © Spartaco Paris

is sought: The interpretation that Vittorio Gregotti offered in his paper about twenty years ago, now a matter of history, on the relationships between architecture, technique, and purpose (Gregotti 2004, p. 252), is still highly convincing. Referring to technique, the Milanese architect observes:

> "the attempt is made to portray it in two different ways: at one time considering technique as a central, structural element, and at another as adhering to the market's emotions and to the incessant innovations that continuous transformation brings. The dualism between formalists and technologists has, in both cases, a profound internal contradiction, however much they fail to achieve reality in one way or in the other. (…) And hence the true "valorists" that we are today; we are the ones seeking to represent, by exalting it, the current situation, the values that exist, and therefore we turn our ability into the way of translating these words. This appears clear in light of the theme of information technology: cybernetic culture, virtual culture, the so-called "technological sublime." This world, that of ancient mythology, of magic – this world has a continuous need to project its ideas forward, and therefore we no longer care about how things were done in times past, but we concern ourselves only with the future, a strange future, but one that also represents the resolution of all problems, and therefore the triumphalist future or the future of disaster."

The paper attempts to shrink the field to the physical environment we build and live in.

A plausible scenario for reacting to an increasingly segmented social, economic, and cultural setting may be that of attempting to operate through new forms of

collaboration in planning activity in the field of the research and development of scientific knowledge, while seizing the opportunities of integrating the knowledge we deal with when operating with newer and newer digital tools.

The pervasiveness of technologies appears to be impacting, in an increasingly evident way, the procedures not only of planning but of managing the environment we live in.

The rapid development of computing and the integration of different disciplines allows the parameters based on which each discipline produces innovation to be radically changed: The disciplines are not just miniaturized, but are also invisible and integrated.

From utilizing technology with the objective of dominating nature, we are rapidly going on to transforming ourselves into entities ready to be shaped by technologies, integrating them physically into ourselves. "At the same time, our own relationship to technology is moving beyond the instrumental to the existential. We do not just use technology. We absorb it." (Khanna and Khanna 2012, p. 14). The coexistence between people and technology is being transformed into human/technological co-evolution.

We therefore have a multitude of continuously evolving technologies that extend our capacity for judging, planning, and controlling the environment we live in. Which will we need? Which ones will we be able to govern? Which ones can help us change our approaches to designing and managing our habitat?

There are at least two accompanying conditions we believe would be useful to emphasize.

The first relates to sharing the programmatic lines of the New European Bauhaus, particularly as regards the approach to renewing the built heritage: It is by all means clear that, for the West and soon for Asia as well, "The twentieth century was a story of building anew, pouring concrete in order to build a way out of poverty, or to conjure new towns and cities out of wartime ruins or developmental missteps. As a result, for many European countries, 80% of the buildings of 2050 have already been built, and some 97% of these existing European buildings will need to be renovated. (...) It implies a refining in place, understanding repair and retrofit cultures, developing new logics predicated on care and maintenance, on true collaboration and participation with diverse cultures and behaviours, and on building anew only where necessary and desirable." (Bason et al. 2020, p. 6). This is in the conviction that there can be no paradigm shift toward the built environment without a new critical, and thus interdisciplinary, capacity toward the hypothesis that regenerating existing construction might be able to produce new resources and values for society at large and for future generations.

The second thematic sphere of approach relates to whether to verify, develop, and more deeply analyze, with a view to operation, the scenario of reference characterizing the digital revolution—the "digital turn"—for the context of architecture, the construction of the built environment. From this standpoint, the conference's contributions in track innovation show interesting and fertile attempts at experimental application of digital technologies as powerful design "materials" for people and their environment.

5.2 Toward a New Paradigm of the Designer in the Digital Turn for the Built Environment. A New Scenario of Knowledge and Skill Integration in Design Processes

Although it has been traditionally characterized by a low technology level and content, the construction industry has also, in recent years, been affected by a development of digitalization throughout the supply chain.

Recent studies (EU Commission 2021) articulate into three main supply chains the spheres of application, with their innovative digital tools, to the construction sector: data acquisition (sensors, Internet of Things, 3D scanning), automating processes (robotics, 3D printing, drones), and digital information analysis (Building Information Modeling, Virtual/Augmented Reality, and Artificial Intelligence, Digital Twin) (Fig. 5.2).

Although at present the spread—at least in Europe—of procurement strategies to raise stakeholders' awareness of the construction sector's digitalization skills and methods is relatively broad and patchy, European policies are incentivizing the entire construction supply chain's digital updating, from planning to development and management.

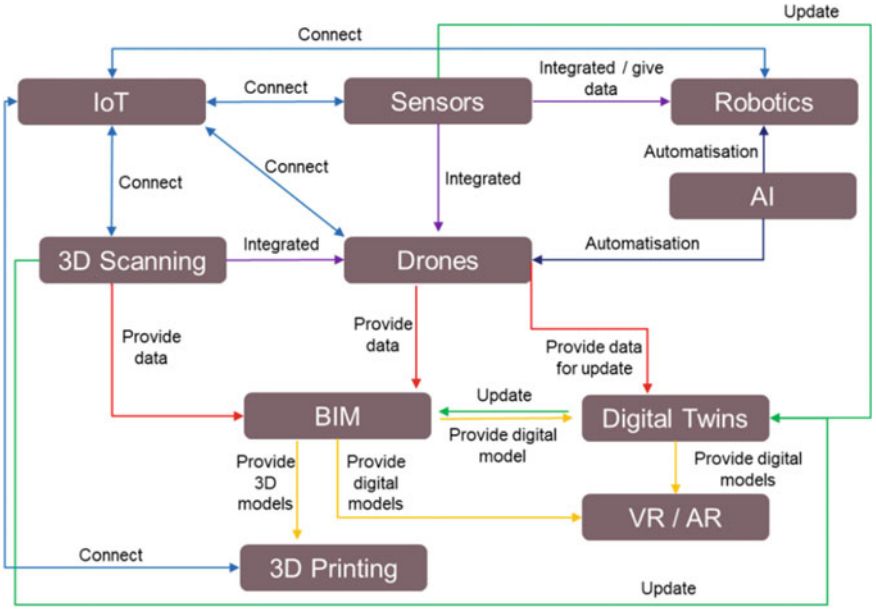

Fig. 5.2 Scheme of interaction among digital technologies in the construction sector 2021 (*Source* European Commission, p.20)

The third of the above-described supply chain—digital information analysis—is the planning activity's specific area of competence; this is if we share an extensive interpretation of the concept of design, as a "projection" of choices—morphological, functional, and technological—relating to people's specific needs. Digital information applied in integrated fashion to the built environment is a rapidly developing frontier that is profoundly transforming the role of the designer within the construction process.

It is interesting to point out that, at bottom, architecture is, from the technical and productive standpoint, far simpler than other industrial sectors that are today using advanced tools to deal with the contemporary world: It is far simpler than a drone or a technological device, but it is functionally far more articulated and is programmatically designed for a rather long life cycle.

In the direction of managing the built environment, the development of information technologies, and in particular of parametric modeling in the field of constructions, is going through a phase of transition toward full operativity and toward changing the approach to planning and managing the built environment. From a primitive phase of transfer to the digital environment of exclusively geometric information typical of the analog method of representing reality, we have transitioned to a long phase, still in progress, of parametric information modeling (BIM approach) in which the base/primitive IT elements are endowed with specific information (characteristics, requirements, performance) and not only geometric information; we are now in an evolutionary phase, that of the so-called Digital Twin already well established in the industrial sectors and in sectors deemed as having high technological content, while still embryonic in the field of construction. For this phase, the digital twin of physical reality might foreseeably contain—thanks to the use of increasingly accessible enabling technologies—"dynamic" information relating to specific behaviors of its true original.

This level of knowledge will be able to guide and facilitate the management—also with a view to sustainability—of the building heritage and is a horizon of technological innovation of development for the entire construction supply chain.

The recent essay entitled *The total designer. Authorship in the Architecture of the Postdigital Age* by L. Ortega attempted to redefine the transformation of the role of the architect operating within the digital transformation of tools and methods that are increasingly available, mature, and powerful.

The proposed programmatic definition of the total or expanded designer merits some reflection, as a figure who, according to the author, may overcome a traditional interpretation of the architect, and about whom a 20-point cultural manifesto is proposed, attributing a political and radical role to the architect in the postdigital era (Ortega 2017, p. 70.71) (Fig. 5.3).

Beyond the political interpretation, which may be more or less agreed with, which Ortega attributes to the "total designer," an avant-garde figure, there are some clear and acceptable aspects of the transformation of the role of the architect, endowed with new tangible and intangible tools for design. Let us attempt to describe them in order to outline a scenario of reference for the present and the future.

1/ Designers tend to limit their projects to certain scales; total designers develop their skills with the intention of learning how to generalize.

2/ Designer teach by transmitting information; total designers teach by creating states of mind.

3/ Designer are politically correct; total designers are political.

4/Designer write about design; total designers texts on design.

5/ Designers care for their design; total designers are obsessed about their projects.

6/Designers are victims of professionalism; total designers are victims of vitality.

7/Designers design with materials; total designers are material organizers.

8/Designers try to communicate their projects in a commercial format, generally by using images; total designers share their experiences and their work through public exhibition, by using drawings.

9/Designers hope for good reviews and approval; total designers are interested in action, not approval.

10/ Designers think and talk about design as a language and a convention and practicing in the discipline consists of belonging to the group that shares the language; total designers work with a material logic and practicing in the discipline consists of skillfully manipulating historical material.

11/ Designers realize diagram through the use of figuration; total designers realize their diagram s performatively, as opposed to translating them.

12/ Designers tend toward singularity; total designers tend toward multiplicity.

13/ Designers try to be economical; total designers love excess.

14/ Designers hate repetition; total designers love iterations.

15/ Designers love novelty; total designers love invention.

16/ Designers love the extremes; total designers love the in-between.

17/ Designers are tempered by limitations; total designers are radical through constraints.

18/ Designers solve problems; total designers generate questions.

19/ Designers don't call their work finished until they feel it is detailed enough; total designers don't have sense of finalization.

20/ Designers think about their next project; total designers always work as though the current project were their last.

Fig. 5.3 L. Ortega, manifesto on the expanded designer or the total designer, the total designer, 2017, p. 70–71)

Without a doubt, the power of processors allows the design prefiguration to be described with modes of reality simulation that are quick and powerful enough to propose a virtual world analogous to the real one. This brings a whole series of implications on the new requirements of the design, which traditionally could proceed by approximations and subsequent deeper analysis; today, it can fix in digital models a hyper-realistic simulation of what does not exist. This is an initial point that also brings to virtual worlds—see the metaverse—the tools of augmented reality, but that resides in the sphere of representation.

The new field of competence of the new digital designer lies in the possibility of attributing specific and customizable requirements to the digital models the designer

creates: This means providing attributes relating to physical and mechanical behavior to the designed virtual environment. These attributes may be verified in reality using sensors: This projects the management of our buildings into an extraordinary, new dimension, already well established in the other industrial fields of application of Digital Twins (see automotive, mechanical industry, bioengineering).

The third field, perhaps the most challenging one, is the need for and appropriateness of working collaboratively among different competences: The medium provided by the model offers the digital design the condition of working in an integrated form, exchanging a model that "grows" and collects information and data through cooperation with other competences. This scenario defines a new and innovative framework for the role of the designer: The traditional designer, placed at the top of a pyramid of competences, was bound to a substantially linear progression of the design activity, ending upon his or her introduction of the designed object into operation; the digital design finds him or herself in a circular processual model and, by maintaining control over the model, operates in "horizontal" form with the other actors; he or she may potentially operate during the entire life cycle of the designed object, thereby amplifying its competences for management.

5.3 Conclusions. Renewal of a Technological Culture of Design

During the years of the growth and fall of the utopia of the Modern Movement, there was a coexistence of antagonistic positions in relation to the role that technological innovations could have produced in the productive processes of transforming the built environment. Radical pioneers of a modernity in which architecture fully entered into an industrial dimension, the formal repertoires—from Archigram to the Eameses, from R. Rogers to Renzo Piano—proposed avant-garde models whose results belong to currents of language rather than to profound transformations of the modes and content of architectural production addressing a technological culture of design.

On the other hand, as Massimo Perriccioli (Perriccioli 2021) observed in his recent studies, these pioneers sometimes sidelined or excluded from the history books on modern and contemporary architecture and from the "official" historiography, had, with their intuitions and experimentation open to technological innovation, prefigured an attitude oriented toward integrating the new tools that the technological advance in the processes and methods of design had ushered in, and toward anticipating themes and issues that are current today: We may consider the environmental issue, social emergencies, the myths of globalization, technological hybridization, the new forms of dwelling, and circular production systems, to cite just a few. This has represented an anticipation of a way of thinking about design and the role of the designer with a confidence in a "friendly" technology, one that does not abuse people's needs. In the twentieth century, this confidence was placed mainly in the material sphere of producing the project: consider the "constructive imagination" that guided such

uncelebrated figures as Peter Rice or Jean Prouvè: and yet, that "integrated" vision of the design in relation to the means and techniques of production is conceptually no different from the designer's attitude in the digital era: the tools, the tool box, that belong mainly to the intangible sphere of the design process, are more powerful, but they guide the role of architecture into a renewed duality of art and industry for the built environment.

The horizon of reference for technological imagination may therefore reside in a new update of a technological culture of design, in which the processual dimension takes equal part in the sphere of artistic practice.

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