Intelligence

MARIA VOGIATZAKI
Anglia Ruskin University (ARU), UK

Technology has always been responsible for the profound transformation of the cultures that developed it. Technological advancements introduce new cognitive and symbolic systems which, however, are not readily apparent as soon as new technologies are developed. It always took longer -even as long as generation lifespans- to assimilate, exploit and turn into practices the cognitive possibilities opened up by any technological innovation [1]. If it is valid to suggest that cultural evolution follows technological evolution, then we can safely assume that we are far from the complete exploitation of the cognitive mutations we are experiencing or encountering in the new technological environment formulated by the recent advancements of communication networks and information processing technologies. However, we can already detect an emergent (social) agenda of humanity which strives for the extension of life from the organic to the inorganic realm, shifting from what we used to call natural processes to what we now understand as intelligent design[2].

The notion of intelligence has become a buzzword that accompanies every possible action, praxis, process or product nowadays. Its dominance in contemporary thinking and practice is grounded on two new and closely related considerations. The first is the ontological mutation of intelligence, from its conception as the exclusive function of the human brain to its definition as a property emerging from a specific set of conditions in which a human or a non-human organism or machine could exist. Intelligence is no longer only a human privilege. The second is the understanding of intelligence not as the outcome of the function of one single organ or center but as the emergent property of the symbiosis and the respective interaction between a 'brain' (human or non-human), a body and the environment(s) in which this body exists. There is an inseparable continuity between any kind of mind and body, body and environment, mind and matter, intelligence and environment. This mutation renders intelligence a symbolic reference of an emerging -if not already established- understanding of the human as part of a new worldview. According to this understanding, the humans are, no longer, the most important and capable distinct beings in the universe having always an antagonistic relationship with their natural environment. They are conceived as embodied in an extended interconnected and networked technological world. The humanitarian rationalism discarded God from the center of the social imaginary to glorify the human intelligence in its perpetual conflict with nature. Posthuman thinking discards the humans from their believed dominance to glorify the planetary intelligence of the living Gaia[3]. Any form of intelligence, human or non-human, is now considered as dynamically interdependent. Any individual intelligence, alive or machinic, is part of a collective alien intelligence.

---

[1] *Pierre Lévy set as an example the print technology which 'fostered the development and progressive formalization of linguistic studies and the creation of metadata systems for the organization of libraries and achives'. Cf. Lévy, P. (2010). From social computing to reflexive collective intelligence: The IEML research program. In: International Journal for Information Sciences, Volume 180, Issue 1, 2, January 2019. Elsevier pp.72.*

[2] *A presentation of this new agenda to the broader public could be considered the case of Harari, Y.N. (2016). HomoDeus. A brief History of Tomorrow. Harvill Secker,London, UK.*

Intelligence, nowadays, underlies notions of control, management, efficiency, but also notions of sensing, abstracting, learning, deciding and acting in either a human or in a non-human manner. In other words, it encompasses all aspects of design, introducing a new design intelligence utterly different from the one generated by the human-centered approaches to creation. It perpetually moves between the effective and smart management of presented resources and the spontaneous creation of smart environments that afford and encourage the participation of anything that could be called user, being it human or non-human. The shift in the conception of intelligence, profoundly affects the contemporary understanding of design of the built environment at any scale and every stage of the design process. We are facing new theorisations and actualisations of the concepts of innovation, creativity, and imagination, three of the main driving forces of the design activity.

Innovation has always been a primary goal of the design of the built environment around which, all human-centered theoretical discourses developed their intellectual foundations to assist the creation of innovative design outcomes. As theory is primarily based upon values, there is always a directed articulation of existing elements towards new and innovative combinations. The development of advanced computation and networking technologies and tools, supported by, and supporting the aforementioned posthuman understanding of the self and the world, expect the collective alien intelligence to open up new directions to innovation. In this context, innovation is no longer considered as the creation of something just entirely new. It is the request for unpredictably unexpected and unthinkable associations and speculations of existing components which were hidden, latent, separated or isolated and conceived as irrelevant by the different theoretical doctrines occasionally dominating the design of the built environment. The request for the 'radically new',[4] is supported by the harsh critiques appearing twenty years ago,to pre-existed theories, defining them as an impediment to the development of an innovation culture in design[5] which has to be replaced by a new intellectual framework supporting rather than inhibiting innovation.

The human-centered paradigm conceives creativity as one of the distinctive attributes of human consciousness such as intelligence, thought, emotion, memory, imagination, awareness, self-knowledge, sense of being. Through psychology, creativity was explained, among others, as a brain function connecting incentives from the two lobs of the brain[6] (Braian Lawson). This can explain the enhancement of creativity linked to the enrichment of external stimuli which could eventually intensify these connections. In the post-human context, creativity is a faculty inseparable from intelligence. As intelligence is primarily based upon pattern recognition and categorisations (abstraction) as well as hierarchical classifications (association), creativity is conceived as a quality of intelligence, assessed by the operational value of the emergent new abstractions and new pattern associations in thinking processes. Since intelligence emerges from specific sets of conditions in the human and non-human continuum mind-body - environment(s), the presence of abstractions assured by the non-human intelligence, devoid of values and prejudices, constitutes a critical factor for new associations of creative intelligence.

Humanists consider prediction as one of the main traits of human consciousness, closely related to our sense of time. Prediction and even more scientific prediction is formed upon human logic. The dynamics and the complexity of the mind-body-environment(s) continuum, render prediction done by humans a somewhat questionable guide for the creation of reality. Not just because it can only be short-term, but mainly because it is based upon preexisting human stereotypes, established prejudices, actual conflicts or entrenching. Imagination, and more specifically, collective imagination is proposed as a fair alternative for the production of reality. Collective imagination, as an attribute of collective intelligence, is conceived as a vehicle towards an unpredictable and not yet 'written' future, which optimistically connotes that we are probably much more liberated than we think; a vehicle for a shift from rational thinking to speculative thinking, that by no means is an invitation to abandon our critical faculties, value references, and socio-cultural standings. On the contrary, the recourse to collective imagination is an encouragement to creatively and efficiently use the powerful tools provided by digital technologies. Pierre Levy reminds us that the significant advances in human cognition are related to inventions of media and symbolic systems. We are facing the challenge to enhance our personal and collective cognitive abilities by engaging ourselves in various intellectual cooperations to invent, innovate and create the new human reality in the 'new reterritorialised agora' of cyberspace[7] and the techno-cultural world of the post-human era.

All the above statements, ideas, and thoughts are to be tested and critically assessed as to their operability, ethics, and tactics. Research in this emergent field is facing a significant challenge and requires at least a provisional cognitive mapping.

---

[3]For a socio-philosophical presentation of the posthuman see Pepperell, R. (2003). The Posthuman Condition: Consciousness beyond the Brain. Intellect Books, Portlanf Oregon, USA and Braidoti, R. (2013). The Posthuman. The Polity, London. For a techno-philosophical approach to the posthuman see Hayles, K. (1999) How we have become Post-Human: Virtual Bodies in Cybernetics, Literature, and Informatics. The University of Chicago Press, Chicago USA.

[4]For a concise investigation of the nature and the adventures of the request for novelty and its relationships with the old see North, M. (2013). Novelty: A History of the New. University of Chicago Press, Chicago, USA.

[5]Cf. Speaks, M. (2005). After Theory. In: Architectural Record Magazine, June 2015. New York pp 72-75.

[6]Cf. Lawson B. (1980). How Designers Think. The Design Process Demystified. Architectural Press, Oxford.UK

[7]Cf. Lévy, P. (2006). Collective Intelligence, A Civilisation: Towards a Method of Positive Interpretation. International Journal of Politics, Culture, and Society, Vol. 18, No. 3/4, The New Sociological Imagination (Spring - Summer, 2005). Springel, pp. 189-198.

This achi DOCT issue, in its effort to contribute to this mapping, invited doctoral research essays focusing on any field related to archtecture and the city, where intelligence is mobilised at any scale
and stage of its theorisation and actualisation. Authors were encouraged to construct arguments for or against any idea of intelligence in general and in design in particular. The issue includes one good practice example and five essays by doctoral students worldwide.

The good practice example has been kindly offered to our issue by Professor Nicos Komninos from Aristotle University of Thessaloniki. The essay originates from a book he authored in 2015 with Routledge with the title The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies. The book is the last part of a trilogy on the theme of Intelligent Cities. The current essay entitled Alternative Architectures of Spatial Intelligence of Cities: Pathways to Innovation continues an argument that suggests that 'the intelligence of cities is based on a series of knowledge functions which are collectively created and deployed, such as network-based information intelligence and forecasting, technology learning and acquisition, collaborative innovation, product and service promotion and dissemination'. The essay is a continuation of these arguments through an appreciation of the different forms of spatial intelligence that are activated by arrangements of knowledge functions and infrastructure into cities. The concept of spatial intelligence of cities and a quick overview of the literature on cyber, digital, intelligent, and smart cities, which points to different types of spatial intelligence, are described. The four trajectories and architectures of spatial intelligence -agglomeration, orchestration, empowerment, and instrumentation- that can be found within cities follow. Cases studies from Bletchley Park UK, Cyberport Hong Kong, Smart Santander and Amsterdam Smart City illustrate the above types of spatial intelligence. These socio-technological experiments highlight important efforts to create intelligent places and contribute to a better understanding of the many faces of spatial intelligence. Last but not least, the essay attempts to draw a synthesis of the different types of spatial intelligence by defining a universal architecture, based on variables such as the type of knowledge functions activated (information gathering, technology learning, innovation, dissemination), the type of intelligence used (human, organisational, artificial), and the type arrangements within the urban space in processes takes place.

The first essay by Alexander Liu Cheng is entitled Machine Learning as enabler of Design-to-Robotic-Operation. Alexander is a PhD candidate at Robotic Building, Faculty of Architecture and the Built Environment, TU Delft (Delft,The Netherlands); and Adjunct Professor / Researcher at Facultad de Arquitectura e Ingenierías, Universidad Internacional SEK (Quito, Ecuador). His essay promotes Artificial Intelligence via Machine Learning ML as a fundamental enabler of technically intelligent built-environments. It does this by detailing ML's successful application within three deployment domains: (1) Human Activity Recognition, (2) Object as well as Facial-Identity and -Expression Recognition, and (3) Speech and Voice Command Recognition. With respect to the first, the essay details previously developed ML mechanisms implemented via supervised classifiers capable of recognising a variety of physical human activities. With respect to the second, it details three previously developed ML mechanisms implemented individually via (i) BerryNet—for Object Recognition; (ii) TensorFlow—for Facial-Identity Recognition; and (3) Cloud Vision API—for Facial-Expression Recognition. Finally, and with respect to the third, it details a presently developed ML mechanism implemented via Cloud Speech-to-Text that enables the transcription of spoken speech—in several languages—into string text used to trigger pertinent events within the built-environment. The sophistication of the so-called Machine Learning collectively imbues the intelligent built-environment with a continuously and dynamically adaptive character that is central to Design-to-Robotic-Operation, which is the Architecture-informed and Information and Communication Technologies-based component of a Design-to-Robotic-Production and Operation framework.

George Tryfonos currently conducting his PhD research at the University of Cyprus that focuses on industrial robotics and-fabrication with tensile – high elastic materials in architecture has contributed to this issue with an essay entitled Automated robotic toolpath generation of elastic mesh structure. An additive waving techniques for form-finding, MOGA optimisation, and robotic fabrication. The essay describes the development of an automated robotically-driven algorithm that can be used for the design, simulate and robotic fabrication of elastic tensile mesh structures. This approach aims to automate the process between design development and additive fabrication phases through the development of a custom-made end-effector tool for physical execution. Specifically, the suggested procedure explores a weaving elastic mesh technique, followed by an automated form-finding and static analysis investigation as well as a direct toolpath generation implemented by an industrial robotic fabrication process. Within this framework, a feedback loop between the form-finding and optimisation algorithm is investigated, which is responsible for controlling the pretension of the elastic threads, aiming to suggest optimum additives robotic tool-paths. In parallel, robot's and end-effector tool's parameters and limitations are taken into account during digital form-finding and optimisation processes. The suggested procedure aims to extend the automated robotically-driven algorithm in order to achieve accurate repeatability control of the elastic material and in turn the effective physical fabrication of complex tensile shapes.

Valerio Perna is the author of the essay entitled Urban Environment from Smart Cities to Playable Cities. Towards Playful Intelligence in the Urban Environment. Valerio Perna is a PhD student at Roma, La Sapienza School of Architecture. As the author suggests, in the last decade, we have seen the rise of urban play as a tool for community building and city-making, and Western society is actively focusing on play/playfulness and intelligent systems as a way to approach complex challenges and emergent situations. In this essay, Valerio Perna aims to

initiate a dialogue between game scholars and architects. Like many creative professions architectural practice may benefit significantly from having more design methodologies at hand, thus improving lateral thinking. Perna also aims at providing new conceptual and operative tools to discuss and reflect on how games and smart systems facilitate long-term the shift from the Smart Cities to the Playable one, where citizens/players have the opportunity to hack the urban fabric and use the smart city's data and digital technology for their purposes to reactivate the urban environment.

The essay entitled Architectural Intelligence is authored by Andreea Movila a PhD Student at Ion Mincu University of Architecture Bucharest. The essay documents and substantiates the notion of Architectural Intelligence, which does not refer to the emerging talks about Building Intelligence, but to the neurosc ence of architecture, and what we can understand about the brain of the architect as he or she designs a building. In the first instance of the study, intelligence is properly situated within the structures of mental organization and then the relationship between the architectural intelligence -perceived as a cumulus of specific mental abilities- and the architectural thinking -as an action, the mental manipulation of the information- is analysed. The premises for an Architectural Intelligence Theory are given by the context of the Theory of Multiple Intelligences developed by the psychologist Howard Gardner that suggests that there are have several types of intelligence - (musical-rhythmic, visual-spatial, verbal-linguistic, logical-mathematical, body-kinesthetic, interpersonal + intrapersonal = emotional) and not a single general intelligence- as perceived until then (the g factor proposed by the psychologist Charles Spearman in the early years of the 20th century). Following Howard's criteria, Andreea has documented the inclusion of Design Intelligence in the realm of the Theory and has developed the connection with Architectural Intelligence as an associated construct. Architect's relationship with the world has always been constantly changing throughout history and the most pertinent question to be answered today is how we can still remain relevant in a world of fantastic changes in which the field limits are subtly absorbed by other domains. The purpose of the study is to question how the role of architecture has been evolving over time, from its primary concern as need for representativeness to nowadays unquantifiable realms that imprint the delicate rel tion to the new paradigm of artificial intelligence.

Last but not least, the essay by Artemis Psaltoglou, an Architect Engineer whose research focuses on urban planning, spatial development and participatory processes, and a PhD candidate at the Department of Urban and Regional Planning (AUTh) is entitled "From Smart to Cognitive Cities: Intelligence and Urban Utopias". The essay elaborates on recent approaches in human intelligence that have provided us with a broader understanding about its multiplicity and its dynamic nature. As the essay argues the human capacity to imagine beyond the existing has led to the creation of utopias as a way to fantasize about future societies and future cities. The current essay explores how the concept of intelligence is reflected in urban utopias. More specifically, it focuses on two current urban utopias, which are the predominant urban visions for the digital era: Smart and Cognitive cities. The vision of smart cities, grounded in the intensive use of information and communication technologies (ICT) for the sustainable development of cities, gained a lot of popularity and a wide range of smart city initiatives have been implemented across the world.

Apart from the criticism for the technological determinism of smart cities and for endorsing a corporate vision of cities, it is argued that the dominant approach of smart cities considers intelligence as a prime technological function. Based on advances in cognitive computing, cognitive cities expand the concept of smart cities through the introduction of cognition and learning. The essay concludes with some thoughts on intelligence and the function of utopian thinking, and underlines the role of technology as one among many interrelated elements that compose our cities.

This invited paper was previously published as an Editorial in archiDOCT Vol. 6 (1) / July 2018 and was generously provided with the concession of Professor Maira Vogiatzaki.