TOWARDS A POST-HUMAN ERA? - DIGITAL ARCHITECTS AND THE FUTURE OF MANKIND

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In this age of unprecedented technological progress, we can no longer ask "what is man?" without examining what we think man will become. In the field of architecture such an examination necessitates considering both what and for whom we will be building in the decades to come. Since the expansion of information and communication technologies in the beginning of the 1990s, the most forward-thinking architects have been asking these very questions. More specifically, digital architects have been among the first in the field, if not the first, to become interested in the effects of technological advancements not only on architectural design and the built environment of the future, but also on society as a whole and on our physical, psychological, and cultural evolution. Thus they have constructed future world visions often impregnated with post-humanist and trans-humanist currents of thought.

"WE CAN NO LONGER ASK 'WHAT IS MAN?' WITHOUT EXAMINING WHAT WE THINK MAN WILL BECOME"

These future world visions are valuable resources in our quest to grasp and understand the contemporary conception of mankind and of mankind's possible futures. Through such commentary this paper aims to show how digital architects have been imagining mankind's future from the 1990s to the present. It will attempt to shed light upon our current state of evolution and its expected outcomes, regarding especially how we relate to the natural and to the artificial.

These relationships have already been profoundly transformed by new technologies and they will be transformed more and more. From the possibility of new modes of being made possible by cyberspace, which architects dreamed of during the 1990s, to the fantasy of a world populated by a new bio-mechanic species of life and truly living buildings, the statement made by the artist Roy Ascott that "[w]e are only interested in what can be made of ourselves, not what made us" takes its full meaning.[1]

CYBERSPACE: THE POSSIBILITY OF NEW MODES OF BEING

The digital turn in architecture occurred at the beginning of the 1990s as a result of the democratization of personal computers.[2] It was contemporaneous with the development of the Internet and virtual reality technologies, leading, during the course of that decade, to the theorization of cyberspace.

The cyberpunk author William Gibson, who popularized the term "cyberspace," described it as "[a] consensual hallucination experienced daily by billions of legitimate operators, in every nation" and "[a] graphic representation of data abstracted from the banks of every computer in the human system."[3] Born around the beginning of the 1980s in science fiction literature, it was depicted as a new level of reality, an entirely new space of living, but an immaterial one which existed in addition to our physical one and was produced by the global interconnection of computers from all over the world. In fact, during all the 1990s, cyberspace provided a basis for reflection on the topic of the transformation of space under pressure of the ICT (Information and communications technology) and of the hybridization of virtual and physical spaces. Moreover, it nourished a new imagination related to a likely transformation of mankind itself as a result of these virtualization processes.

In the fields of architectural and urban theory, a number of research papers and publications emerged in this decade. *Cyberspace: First Steps* by Michael Benedikt (1991),[4] *Being Digital* by Nicholas Negroponte (1995),[5] and *City of Bits* by William Mitchell (1996)[6] demonstrated the involvement and interest of architects in this emerging digital society and its implications. The publication of the issues of the *Architectural Design* review "Architects in Cyberspace," in 1995[7] and "Architects in Cyberspace II" in 1998,[8] bringing together the contributions of the so-called "cyber-architects" (Marcos Novak, Neil Spiller, John Frazer, Karl Chu, etc.), celebrated the "digital turn" in architecture as well as the community of thought that gathered around the topic of architecture, ICT, and digital architecture.

These works were mostly focused on the issue of dwelling, seeking

to redefine what it means to inhabit at a time when the virtualization of space was seen as capable of creating a transformation in man. Immersion in virtual spaces and, therefore, the mind-body problem, were examined with a view to the future of man (individual, subject, or species) and his technological hybridization. It is not surprising, then, that the *Architectural Design* issue "Architects in Cyberspace" ended with a paper by Stelarc entitled "Towards the post-human: From Psycho-body to Cyber-system," in which the artist announced the obsolescence of the biological body and the entry of the human into a post-evolutionary era.[9]

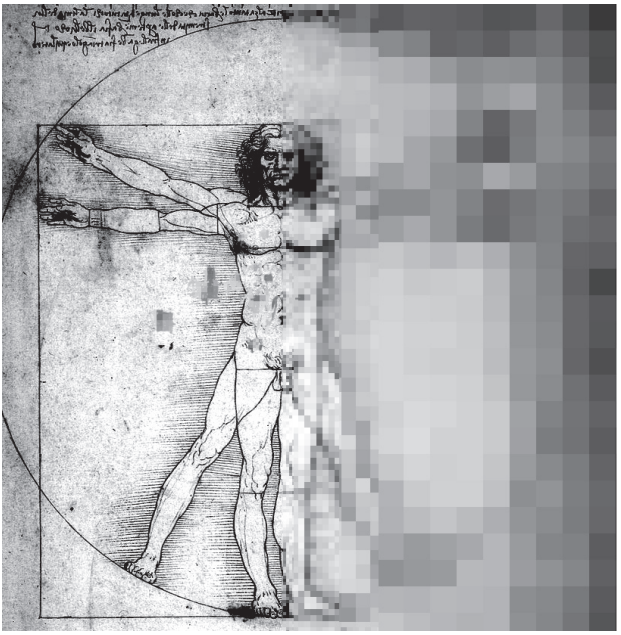

FIGURE 1: TRANS-VITRUVIAN MAN

Creating visions of the world to come, reflecting on the evolution of mankind and society, the "cyber-architects" flirted with trans-humanist currents of thought and definitions of the post-human. Differentiating itself from philosophical-cultural post-humanism and from technological post-humanism, trans-humanism promotes the enhancement of human intellectual, physical, and psychological capacities through techniques such as stem-cell therapy, genetic engineering, psycho-pharmacology, anti-aging therapies, neural interfaces, machines, and other mechanical enhancements.[10] By taking control of the evolutionary process and thus liberating the human species from its biological limitations, trans-humanists aim to attain a post-human existence whose visions range from the post-human as a

cybernetic organism; a digital, disembodied entity; to even a new biological species.[11] In the process, the definition of the human would evolve, perhaps in unpredictable ways.

Most of the digital architects believed that the emergence of cyberspace would truly transcend everything we know.[12] "What would architecture be in this sphere of virtuality?" asked Karl Chu in 1995, before answering: "No one knows for sure, however one thing is certain, traditional conceptions of territory, of dwelling, of identity, of the phenomenology of existence and being will no longer be the same."[13] Thought as a true phenomenological, perceptual, and phenomenal environment, cyberspace opened the possibility of new modes of being, and even of, in Michael Benedikt's words, "another venue for consciousness itself."[14]

Marcos Novak, pioneer of virtual reality and algorithmic architectural conception, exemplified this idea with a virtual environment called "Dancing with the Virtual Dervish: Worlds in Progress" (1991-1994) in which performers were compared to mystic Sufis in trance, immersed in a vision, an inner journey, exploring the meanderings of the human mind. Generated from musical algorithms and L-Systems (a formal and generative grammar used to model and simulate growth in plants), this environment was made up of an increasing number of chambers interconnected on the rhizome model, without any narrative hierarchy or determined development, and without beginning or end, thus leading to ways of being in space totally different from what we experience daily.[15]

For the British artist Roy Ascott, in the same spirit, cyberspace-induced transformations in the concept of inhabiting were considered so important that architecture needed to be fully rethought and urban strategy to be re-conceptualized.[16] In fact, according to Ascott, new perceptual and cognitive abilities should have emerged from our relation to information and communication technologies, expanding our sensory apparatus and connecting our individual bodies. The ability to be both here and there at the same time, which cyberspace should have permitted, should have enabled new ways of thinking and perceiving. The "post-biological faculty of cyberception," as called by Ascott, should have constituted a true "qualitative change in our being." He claims, moreover, that:

> *[n]ot only are we changing radically, body and mind, but we are becoming actively involved in our own transformation. […] Our consciousness allows us the fuzzy edge on identity, hovering between the inside and the outside of every possible definition of what it is to be a human being. We are all interface. We are computer-mediated and computer-enhanced.*[17]

By the late 1990s, it was conceded that what cyberspace architects

had dreamed of was nothing but a fantasy. The inspiring word "cyberspace" became a synonym for the more prosaic Internet, making it clear that there was no distinct virtual space separated from our physical one. It was also conceded that what happened in the electronic space of data and information networks in fact happened in our daily space, now hybridized by virtual technologies. Even William Gibson recognized that "[c]yberspace, not so long ago, was a specific elsewhere, one we visited periodically, peering into it from the familiar physical world. Now cyberspace has everted. Turned itself inside out. Colonized the physical."[18]

The installation "Trans-ports" presented at the Venice Architecture Biennial 2000 by the Dutch artists Kas Oosterhuis and Ilona Lénárd, founders of the ONL Agency, is a striking example of this merging. Trans-ports was an experiment in data-driven architecture: its structure was thought as reconfigurable in real-time in actual space as Internet users manipulated its online 3D model. Concomitantly, data collected in the physical space would also modify the structure, this modification being reverberated online, changing the 3D model. Then the connectedness and interdependence between physical and virtual spaces would be made obvious. Moreover, the "Trans-ports" inner skin was designed as a giant and continuous screen projecting information from websites or webcams, completely immersing visitors in data. This inner skin is conceptually very close to the hyper-surface architecture theory developed by Stephen Perrella during the 1990s, where architecture was conceptualized as a media surface melting the virtual and the built environment into a single hybrid space.

> "WILLIAM GIBSON RECOGNIZED THAT CYBERSPACE HAS EVERTED. TURNED ITSELF INSIDE OUT. COLONIZED THE PHYSICAL"

Even if the fantasy of cyberspace had vanished, the insights developed by Roy Ascott remained deeply relevant. Beyond the traditional natural-artificial debate thenceforth thought as obsolete,

what persisted was the idea of an intentionally and technologically directed self-transformation of humankind; and this some years before the German philosopher Peter Sloterdijk wrote two essays on that very same proposition respectively entitled *Rules for The Human Zoo*[19] and *The Domestication of Being*.[20] According to Sloterdijk, anthropogenesis is the result of anthropotechnics: human beings produce their own identity by means of technics (technological techniques). Neither technics nor technology would be "against" man: we would not be dealing with dehumanization by technology. On the contrary, such self-transformation would fully be part of a greater, and genuine, effort to strive for a better humanity.

The architect Rachel Armstrong expressed a very similar idea in 1998. She stated that "all mechanised individuals, regardless of their degree of integration with technology, remain fundamentally human.[...] This transformation of the body is not an artificial process; on the contrary, it is a natural extension of our humanness. Our species has elevated itself on the Earth by its capacity to use machines, not by its innate genetic programming."[21] Yet, due to, for example, the emergence of new species of life, be they digital, mechanical, or bio-mechanical, the place of man on the earth could well change faster than we expect, and in such a radical way that it could lead to the extinction of humankind itself.

TOWARD NEW SPECIES OF LIFE: TOWARD THE DEATH OF MANKIND?

In 2002 Kas Oosterhuis declared that, "[d]igital life may well assimilate us completely in the end, so that we no longer need to pretend that we are the be-all and end-all of evolution."[22] This architect, clearly, shared a theory of personality like that of Vernor Vinge or Ray Kurzweil, who popularized the hypothesis of 'singularity.' Singularity is the idea that we are at the dawn of a 'technological leap' determined by the exponential growth of computer power that will result in the emergence of artificial super-intelligences. Proponents of singularity believe that, at some point, progress will be the accomplishment of these artificial intelligences only, with humanity becoming obsolete. In the same way, we would no longer be in charge of our own future: the super-intelligences would decide for us; choosing to annihilate us, absorb us, or let us live as they saw fit.

This technological post-humanist concept of the post-human is quite different from that of trans-humanism or from that of philosophical-cultural post-humanism. In fact, whereas trans-humanism embraced the project of creating radically enhanced humanity, and whereas in philosophical-cultural post-humanism the concept of the post-human serves as a basis for a new narrative that would not engage "the literal

end of man but the end of a particular image of us,"[23] technological post-humanism envisions the very disappearance of the human species. Its project, therefore, is not concerned with the human but with the production of an artificial alterity that would not only be no longer human but would in fact supersede us, leading to a completely post-anthropocentric, non-human world.

Karl Chu does not explicitly embrace that singularity idea, but his future world vision seems close to that of technological post-humanism. Since the late 1990s he has been announcing the advent of a post-human era which he has termed the 'hyperzoïc era'. This hyperzoïc era, a "Brave New World more fantastic and hyperbolic than anything we have seen in the history of human civilization,"[24] would be not unlike the Cambrian era—an explosion of diversification and complexity. It would be characterized by "the profusion of a new type of life; the Artificial Life of abstract machines and architecture, which will be reflected in a new type of bionic economy of the mecanosphere, coinciding with the biosphere."[25]

"THE WORLD IS NOW MOVING INTO THE SO-CALLED POST-HUMAN ERA"

He reiterated the same ideas in 2004:

> *Finally, with the convergence of computation and biogenetics, the world is now moving into the so-called Post-Human Era, which will bring forth a new kind of bio-machinic mutation of organic and inorganic substances. […] It is only a matter of time before the world will witness biomachinic mutation of species proliferating into every facet of what so far has been the cultural landscape of humanity. Architects take note: this is the beginning of the demise, if not the displacement, of the reign of anthropology, which has always subsumed architecture. […] The potential emancipation of architecture from anthropology is already affording us to think for the first time of a new kind of xenoarchitecture with its own autonomy and will to being.*[26]

The emphasis put on the possibility of creating

new species of architectural life (that is, living buildings) from scratch, through the use of genetic engineering and synthetic biology, is very interesting. Even more interesting is the idea that, in the same way, architecture, which, according to Chu, "has always been a subset of anthropology," "especially from the standpoint of its mythical inception,"[27] would no longer be subsumed by anthropology. This idea is not, however, developed further and nothing is said about what could become of human beings in this new environment, except that it "may lead to conditions that are so precarious and treacherous as to even threaten the future viability of the species, Homo sapiens, on Earth."[28]

While also largely adhering to a post-anthropocentric trans-humanist view, Marcos Novak's reflection on these issues is more intriguing. According to Novak, we would become alien. In 1998, referencing Nietzsche, he wrote that if the project of modernity might be characterized by the desire to build the super-man, our (post-modern) time would in turn be characterized by the desire to build what he calls "the alien."[29] In 2002 he stated, again referencing Nietzsche and the end of theo-centrism, that the production of the alien, encompassing all aspects and areas of our reality, would lead to the death of mankind. "Allocentrism" would then replace anthropocentrism, undermining the traditional definition of the human.[30] "The death of mankind" is not intended, however, to suggest some sort of "literal, alarmist, and paranoid apocalyptic fear." It implies, rather, that mankind is an ongoing project,[31] and that this ongoing project, according to the architect, would tend toward the alien.

This idea can be linked, first, to what the French philosopher Michel Foucault claimed in *The Order of Things*: that is to say that "man is an invention of recent date. And one perhaps nearing its end."[32] "Man is […] a figure not yet two centuries old, a new wrinkle in our knowledge, and […] he will disappear again as soon as that knowledge has discovered a new form."[33] Thus, to say that mankind is an ongoing project tending toward the alien is to say that our understanding of what is mankind, our conception of man, is shifting. Secondly, in order to understand what it means to become alien, the whole conceptual landscape of Marcos Novak needs to be examined, beginning with its central notion of 'transmodernity.'

Developed in the middle of the 1990s, 'transmodernity' refers to the idea that our era is characterized by all that the prefix 'trans-' entails: 'beyond,' 'across,' 'through,' 'so as to change.' Under the pressure of new technologies and hybridization of virtual and actual spaces, all the traditional taxonomies (dead/alive, natural/artificial, human/non-human, etc.) would be erased, giving birth to new conditions, new situations,

new events, new bodies, and new identities. Thus, the main effect of transmodernity would be the "production of the alien." To sum up, our world would become stranger and stranger, and so would we: "[t]his is no surprise: transmodernity is about becoming: becoming alien."[34]

In "Speciation, Transvergence, Allogenesis: Notes on the Production of the Alien," Novak stated that if in the past our interest has been focused on evolution as a continuous process of adaptation (relying on such concepts as fitness), today it is diversity and the discontinuous mechanisms of speciation which might retain our attention. Drawing an analogy with biological processes (an analogy which requires, however, further explanation), Novak claims that:

> *[t]o say that we are a transmodern culture is thus to say that we have placed ourselves into a period of rapid and intentional cladogenesis. To say that transmodernity is characterised by the production of the alien is to say that our cladogenesis is directed towards what I term allogenesis.*[35]

BIG BANG 2.0: BUILDING A BRAVE NEW WORLD?

'Cladogenesis' refers to a mode of evolution by branching, in which a parent species splits into two distinct species, the new species then being fed by the same genetic material as the one from which it originated. The neologism 'allogenesis' refers to the emergence of new species from every available material—genetic, epigenetic, or even non-genetic. Allogenetic processes are more discontinuous than cladogenetic and can lead to the emergence of "alien" species. This does not, however, mean that we would be dealing with a radical rupture but rather that the continuous movement of becoming, now incorporating new technologies, would direct mankind towards exceptionally rapid changes.

Although intentionally and technologically

initiated by human design, allogenesis might result in beings which would be impossible to predict. It would moreover concern not only mankind but also the production of other species. As Novak announced in 2008:

> *Established species were once mutant. There is a deep relationship between how the new is conceived, produced, introduced, and established in nature and how the new emerges in culture […] we have finally developed tools powerful enough not only to represent or describe the processes of development and speciation by which the new enters the world, but to simulate them, and then, beyond that, to actually embody them. We will not stop at simulating the evolution and mechanisms of life; we aim to manufacture new species of life itself.*[36]

Novak's discourse is very similar to that of Karl Chu. Novak and Chu in fact worked on similar projects that involved the growing of truly living buildings. One example of this 'alloarchitecture' (Novak's term) is the project "AlloBio" (2001-2004), which is defined as an anticipation of the convergence of the virtual and the actual, the psychological and the cybernetical, the architectural and the biological. It may be one of the first examples of what Neil Spiller calls 'post-digital architecture': not architecture without any digital component, but a synthesis between the virtual, the actual, the biological, the cyborgian, the augmented, and the mixed.[37] "AlloBio" was described as the first specimen of a hybrid singular species, an 'allo-living' creature at the intersection of architecture and biotechnology. "AlloBio" might pave the way for buildings which would no longer be manufactured but would grow as plants or animals grow and would couple the virtual and the actual within reflexive and evolving spaces, fed both by data from computer networks and from events taking place in physical space.

AlloBio might be said to have an awareness, a consciousness, and an intentionality of its own. As truly intelligent architecture,

> *[it] would have evolving personalit[y] that wouldn't just behave differently in response to our behavior, but would also change and strive to change us. We would not command [it]; rather we would be in dialogue with [it]. Sometimes we would persuade [it] to do as we wish; sometimes [it] would persuade us.*

This statement is indicative of the desire to establish more respectful relationships with our environment, beginning with our buildings. Beyond the ecological imperative which guides architects such as Dennis Dollens, Michael Hensel, Rachel Armstrong, and Alberto T. Estévez,[38] there appears to be a desire to create a new world, which is not only our own making but also a product of an ongoing dialogue with these kinds of alien architectures.

The idea that it might be possible to create a new world, or that a new world might be about to emerge thanks to biotechnology, nanotechnology, cognitive science, and informatics, is not unique to Chu and Novak. It is also shared by Roy Ascott. According to Ascott a new Big 'B.A.N.G.' would result from the convergence of bits, atoms, neurons, and genes, hybridizing the dry silicon digital domain of computers and the wet biological world of living systems. The birth of this new world might be so transformative that human identity itself might be pushed to a much more complex level. For Ascott the questions "[w]hat is to be human?" and "how do we deal with the responsibility of redefining nature and life itself?"[39] emerge as key questions for our era. Both are of equal importance and are deserving of being treated urgently both in scientific and in artistic fields.

> "THE ARTIFICIAL IS NOW PART OF OUR NATURE, AND NATURE IS IN LARGE PART ARTIFICIAL"

As Ascott wrote: "The artificial is now part of our nature, and nature is in large part artificial."[40] Moreover: "In as much as we are a part of nature, we wish now to be consciously involved in its co-evolution, which is to say in our own self-definition and reconstruction."[41] The fact that the questions "what is it to be human?" "what will man become?" and "what do we want nature to become?" were addressed jointly merits some attention. Now, more than ten years after the publication of Ascott's paper, it is possible to create new species of life almost from scratch with the help of what are called 'living technologies' (synthetic biology, genetic engineering, etc.).[42] Through these technologies nature is in fact compelled to adapt to mankind: "technology, often depicted as the enemy of nature, will bring us closer to it, but it will be a nature entirely re-described, and re-aligned to our post-biological sensibilities."[43] Even in the context of ecological crisis, nature is seen as something to enhance so that it can continue to meet our needs.

Between 2003 and 2014 the Genetic

Architectures Research Group (which includes Alberto T. Estévez, Dennis Dollens, and Karl Chu) developed bioluminescent lemon trees which could be used for street lighting by implanting in their cells genes extracted from jellyfish which produce a fluorescent protein (GFP). Between 2007 and 2010 the same Genetic Architectures Research Group led experiments to develop living tissue and cell masses as a building material, allowing living walls to be constructed autonomously, or rather to grow on their own. This latter project is quite similar to that of the New York architecture firm Terreform One named "In Vitro Meat Habitat" (2008), which is a prototype of organic architectural skin made of pig cells via 3D printing. In 2015 the American-Israeli architect and designer Neri Oxman presented "Mushtari", a life-support system made for intergalactic travelers and consisting of a prosthetic organ filled with synthetically modified micro-organisms. Pointing out that the two bacteria at work in this project never meet in the wild, she said: "Think of it as evolution not by natural selection, but evolution by design."[44]

This statement is representative of the way living species are instrumentalized. No matter how important the ethical and philosophical questions raised by the possibility of engineering life may be, architects such as Amstrong, Estévez, Oxman, and Michael Hensel do not seem to be eager to develop critical reflection on their practices. Similarly, however 'alive' buildings might become, they would not become free from subservience to human beings. Significantly, in her book *Living Architecture: How Synthetic Biology Can Remake Our Cities and Reshape Our Lives*, Rachel Armstrong asked: "Perhaps our homes could care for us, come to our rescue, or even love us?"[45] In other words the end of anthropocentrism which Karl Chu announced has not yet come. As, as it would seem, our human mindset is not changing, there would seem to be little possibility that we could in fact build a better world.

CONCLUSION

During the last thirty years avant-garde architects have been working on what and for whom they will build in future decades. During the 1990s architects dreamed of a totally artificial and immaterial world. Thus freed from terrestrial anchorage, enabled to become pure information, mankind would have become post-human, as post-biological beings in a computer simulation run by machines (undeniably like the fantasy world of *The Matrix*).[46] During the 2000s it was realized that this would not be so. The exponential growth of technologies, new and old, was making everything we know—the artificial, the natural, or the hybridized—more

and more complex. Our gaze therefore turned to the biological realm as the place where we might create new forms of biomachinic life, questioning and subverting our relationships to the world, to nature, and to ourselves. During the 2000s, however, we were not able to produce these new forms of life, and Marcos Novak's "AlloBio" building, for example, remained but an imaginary architecture.

As, however, science and technology improve, it may yet be possible to re-engineer the biology of the whole of nature and to build a 'Nature 2.0.' It would, then, be time to ask important questions—those very same questions which architects have always pondered. What kind of world do we want to live in? What kind of relationship with nature do we want to have? What pathway do we want to follow concerning our own evolution? A new paradigm is needed, as Chu suggested, for our role as active agents in the transformation of our environments and, indeed, of our universe at large.[47] Such as new paradigm is necessary for at least two reasons: firstly, because those who are currently shaping the new world often fail to take stock of their responsibilities, and, secondly (and perhaps more importantly), as pointed out by Roy Ascott, because what we will do to our environments is part of the definition of what we will ourselves become. While much seems unclear, one thing at least is certain: the way we will transform nature will influence our own evolution.

"WHILE MUCH SEEMS UNCLEAR, ONE THING AT LEAST IS CERTAIN: THE WAY WE WILL TRANSFORM NATURE WILL INFLUENCE OUR OWN EVOLUTION"

ENDNOTES

[1] Roy Ascott, "The Architecture of Cyberperception," *Architectural Design* 65, no.11/12 (1995): 38.

[2] It must be acknowledged that if the democratization of the personal computer was the condition for the possibility of the digital turn—this democratization permitting every architect and

every architecture firm to have a computer—the digital turn would of course never have happened without the development of 3D modeling software that allowed architects and firms to design forms on screen that would be impossible to hand draw, even making it possible to add a temporal dimension to the design. See Antoine Picon, *Digital Culture in Architecture: An Introduction for the Design Professions* (Basel: Birkhauser, 2010); and Mario Carpo, ed., *The Digital Turn in Architecture 1992-2012* (London: John Wiley & Sons Ltd, 2013).

[3] William Gibson, *Neuromancer* (New York: Ace Books, 1986), 51.

[4] Michael Benedikt, ed., *Cyberspace: First Steps* (Cambridge: The MIT Press, 1992).

[5] Nicholas Negroponte, *Being Digital* (New York: Alfred A. Knopf, 1995).

[6] William Mitchell, *City of Bits* (Cambridge: The MIT Press, 1996).

[7] *Architectural Design* 65, no.11/12 (1995).

[8] *Architectural Design* 68, no.11/12 (1998).

[9] Stelarc, "Towards the Post-Human. From Psycho-body to Cyber-system," *Architectural Design* 65, no.11/12 (1995): 90-96.

[10] Hava Tirosh-Samuelson, "Transhumanism as a Secularist Faith," *Zygon 47*, no.4 (2012): 716-717.

[11] Robert Ranisch and Stefan Lorenz Sorgner, "Introducing Post- and Transhumanism," in *Post- and Transhumanism: An Introduction*, eds. Robert Ranisch and Stefan Lorenz Sorgner (New York: Peter Lang, 2014), 7-8.

[12] According to John Frazer, however, cyberspace was not the cause but the symptom of this profound transformation: "The parallel world of cyberspace […] is just one manifestation of deep cultural and technical changes which are reshaping our understanding of our world," he wrote in 1995, stressing that this paradigm shift is characterized by "the shift of perception from an universe of objects to one of relationships." See John Frazer, "The Architectural Relevance of Cyberspace," *Architectural Design* 65, no.11/12, (1995): 76.

[13] Karl Chu, "Modal space: The Virtual Anatomy of Hyperstructures," *Architectural Design* 65, no.11/12, (1995): 69.

[14] Michael Benedikt, "Cyberspace: Some Proposals," in *Cyberspace: First Steps*, ed. Michael Benedikt (Cambridge: The MIT Press, 1991), 124.

[15] Marcos Novak, "Dancing with the Virtual Dervish: Worlds in Progress," in *Immersed in technology, art and virtual environments*, eds. Marie Anne Moser and Douglas MacLeod (Cambridge: The MIT Press, 1996), 303-308.

[16] Ascott, "The Architecture of Cyberperception," 40.

[17] Ibid. 38.

[18] William Gibson, "Google's Earth," *New York Times* (New York, NY), August 31, 2010, http://www.nytimes.com/2010/09/01/opinion/01gibson/html?scp=1&sq=william+gibson&st=nyt.

[19] Peter Sloterdijk, "Rules for The Human Zoo: A Response to the Letter on Humanism," trans. Mary Varney Rorty, *Society and Space* 27 (2009): 12-28.

[20] Peter Sloterdijk, *Die Domestikation des Seins. Für eine Verdeutlichung der Lichtung* (Frankfurt am Main: Suhrkamp, 2000).

[21] Rachel Armstrong, "Body Machine," *AD Architectural Design* 68, no.11/12 (1998): 92.

[22] Kas Oosterhuis, "Yes, We Build Spaceships," in *Architecture Goes Wild* (Rotterdam: 010 Publishers, 2002), 30-37.

[23] Ihab Hassan, "Prometheus as Performer: Towards a Posthumanist Culture?," *The Georgia Review* 31, no.4 (1977): 845.

[24]Karl Chu, "The Turing Dimension," *Archilab*, published 2000, accessed October 20, 2016, http://www.archilab.org/public/2000/catalog/xkavya/xkavyaen.htm.

[25] Karl Chu, "X Phylum," *Domus* 822 (2000): 42-45.

[26] Karl Chu, "Metaphysics of Genetic Architecture and Computation," *Perspecta* 35 (2004): 78.

[27] Ibid.

[28] Ibid. 76.

[29] Marcos Novak, "Alien Space: The Shock of The View," *CIRCA Art + Technology Supplement* 90 (1998): 12-13.

[30] See Marcos Novak, "Speciation, Transvergence, Allogenesis: Notes on the Production of the Alien," *AD Architectural Design* 72, no.3 (2002): 66. Novak writes:

> *Renaissance humanism, the anthropocentric production of the philosophical notion of Man, followed an era preoccupied with the theocentric production of the philosophical notion of God. The birth of Man eventually led to the collapse of theocentrism, which Nietzsche characterised as the 'Death of God', thus, I suggest, beginning a series: the production of God (PoG) is followed by the production of Man (PoM); the production of Man leads to the death of God (DoG); the production of Man is followed by the production of the Alien (PoA), which, in turn leads to the death of Man (DoM). […]*

In other words, centrifugal allocentrism is now displacing anthropocentrism, just as anthropocentrism displaced theocentrism, with the alien taking the place of the Nietzschean overman, and extending itself past all human limits to encompass all aspects of our constructed reality.

[31] Ibid. 67.

[32] Michel Foucault, *The Order of Things: An Archaeology of the Human Sciences* (New York: Routledge, 2002), 422.

[33] Ibid. xxv.

[34] Marcos Novak, "Transarchitectures and Hypersurfaces, Operations of Transmodernity," *Architectural Design* 68, no.5/6 (1998): 85.

[35] Novak, "Speciation, Transvergence, Allogenesis," 67.

[36] Marcos Novak, "Alien Beauty: Immanent Design. AlloAtomic Transarchitectures for Automutant (Allo)Selves," in *Manufacturing – Share Festival* 2008, ed. Bruce Sterling (Turino: Share Festival, 2008), 143.

[37] Neil Spiller, "Plectic Architecture: Towards a Theory of the Post-Digital in Architecture," *Technoetic Arts: A Journal of Speculative Research* 7, no. 2 (2009): 95-104.

[38] Marcos Novak, interview by Alessandro Ludovico, *Neural*, published April 2001, accessed October 20, 2016, http://www.neural.it/english/marcosnovak.htm.

[39] For all of them, the artificial life of architecture may be one of the answers to the ecological crisis. On that matter, see Denis Dollens, "Architecture as Nature: A Biodigital Hypothesis," *Leonardo* 42, no.5 (2009): 412–420; Alberto T. Estévez, "Genetic Architecture: New Ecologic-Environmental Architectural Design & New Cybernetic-Digital Architectural Design," in *Genetic architectures*, ed. Alberto T. Estévez (Santa Fe: Lumen Books; Barcelona: SITES Books/Escola Tecnica Superior d'Arquitectura, 2003), 4-19; Rachel Armstrong, *Living Architecture: How Synthetic Biology Can Remake Our Cities and Reshape Our Lives* (New York: TED Books, 2012); Michael Hensel, "(Synthetic) Life Architectures: Ramifications and Potentials of a Literal Biological Paradigm for Architectural Design," *Architectural Design* 76 no.2 (2006): 18–25.

[40] Roy Ascott, "Moistmedia, Technoetics and the Three VRs," *ISEA2000*, published 2000, accessed October 27, 2016, http://www.isea2000.com/actes_doc/01_ascott.rtf.

[41] Ibid.

[42] See Mark A. Bedau, John S. McCaskill, Norman H. Packard, and Steen Rasmussen, "Living Technology: Exploiting Life's Principles in

Technology," *Artificial Life* 16, no.1 (2010): 89-97.

[43] Ascott, "*Moistmedia, Technoetics and the Three VRs.*"

[44] Neri Oxman, "*Design at the Intersection of Technology and Biology*" (presentation, TED2015, Vancouver, Canada, March 2015), accessed March 09, 2016, https://www.ted.com/talks/neri_oxman_design_at_the_intersection_of_technology_and_biology?language=en.

[45] Armstrong, *Living Architecture*.

[46] *The Matrix*, directed by Lana and Lilly Wachowski (Burbank, CA : Warner Bros, 1999), DVD.

[47] Chu, "*The Turing Dimension*."