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## GAMETECTURE: ARCHITECTURAL FORM IN AUGMENTED REALITY

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### GRATEKTURA: FORMA ARCHITEKTONICZNA W ROZSZERZONEJ RZECZYWISTOŚCI

#### Abstract

Architectural forms of the digital age are based on games and computer simulations: formation, *information*, *transformation*. Formation means creation of structures as extensions of the kinetic potential of the human body (form as skin or wrapper). *inFormation* is based on the active power of information (interactive and intelligent structures). *transFormation* means sequences of forms as mutations of primary structures in topological space (metamorphic forms).

*Keywords: architectural form, strategic games, spatial simulations, virtual reality*

#### Streszczenie

Architektoniczne formy ery digitalnej powstają na drodze gier i symulacji komputerowych: formacja, *informacja*, *transformacja*. Formacja oznacza tworzenie struktur jako przestrzennej ekstensji kinetycznego potencjału ludzkiego ciała (forma jako skóra lub opakowanie). *inFormacja* jest równoznaczna z kreacją form w oparciu o sprawczą rolę informacji (interaktywne i inteligentne struktury). *transFormacja* oznacza tworzenie sekwencji form jako mutacji struktur pierwotnych w przestrzeni topologicznej (formy metamorficzne).

*Słowa kluczowe: forma architektoniczna, gry strategiczne, przestrzenne symulacje, rzeczywistość wirtualna*

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Architectural games with space-time are an intellectual adventure in search of the potential and possibilities of architectural form's transformations in digital era of design. Virtual space-time can be defined as a digital representation of the real world, controlled on different levels of complexity of multidimensional information space. The architectural software makes it possible to create virtual representations of real structures and to generate every sequence of spatial objects in n-dimensional space. Simulation games, based on 3D-computer programs, are the tools for creating new generations of architectural forms thanks to differentiation of their inner structures.

Models of virtual space are founded on the fundamental dimensions of reality, such as: space, time, matter, energy and information. These dimensions are not treated as separate and independent, but constitute a unity. This means that every change in a parameter of spatial structures in one dimension influences parametric quantities in other dimensions [17]. The architectural form in VR can be defined as organized and informed space-time structure [5, p. 405–408; 7, p. 59–67].

Concepts of architectural form refer to different philosophical ideas, describing the spatial settings of an individual's life in the aspect of a phenomenon of human nature. In the digital era, the individual is confronted with such artificial creatures as *avatar*, *cyborg* or *hybrids*. Discoveries in genetic engineering make it possible to manipulate human genes. A new kind of human being can come into existence in the way of passing from natural to cultural evolution (from *homo sapiens* to *robo sapiens*), which could have an impact on the mutual relations between the individual and the spatial settings of human life [Ill. 1].

The concepts of human being and architectural form, according to Georges Teysot, were defined from a spiritual, organic or structural point of view in the history of architecture [20, p. 72–84]. Today, we can observe a different way of thinking about the individual and spatial structures – the macroscopic perspective – which describes all the phenomena in the system-information categories.

## **1. The individual and their extensions: a reflection on the human condition**

Present-day artists and architects show different possible ways of exploring space-time in the near future, which require re-definitions of the notion of the individual and architectural form. These artistic visions are like litmus papers, showing possible directions of development for our civilization [2]. Analysing their hidden meanings, it is possible to distinguish some fundamental trends in the search for definition of the individual and their spatial settings: the human body as the biological, biotechnological or trans-biotechnological organism, connected with different concepts of spatial context of the body (wrapper, electronic peripheries and hybrid extensions).

In the world of artistic experiments, the spatial settings of biotechnological or hybrid human bodies transform continuously. These experiments are an inspiration for the futuristic visions of architects, who try to define different design strategies in relation to changes in the concept of the individual: from formation, leading to creation of the spatial structures as

wrappers for the biological body of the individual, through *information*, initiating the interactive structures, addressed to biotechnological concept of the individual, to transformation, generating the sequence of metamorphic forms for trans-biotechnological concept of the individual [5, p. 405–408].

## **2. Skin and the wrapper: reflection about sensuality of architectural form**

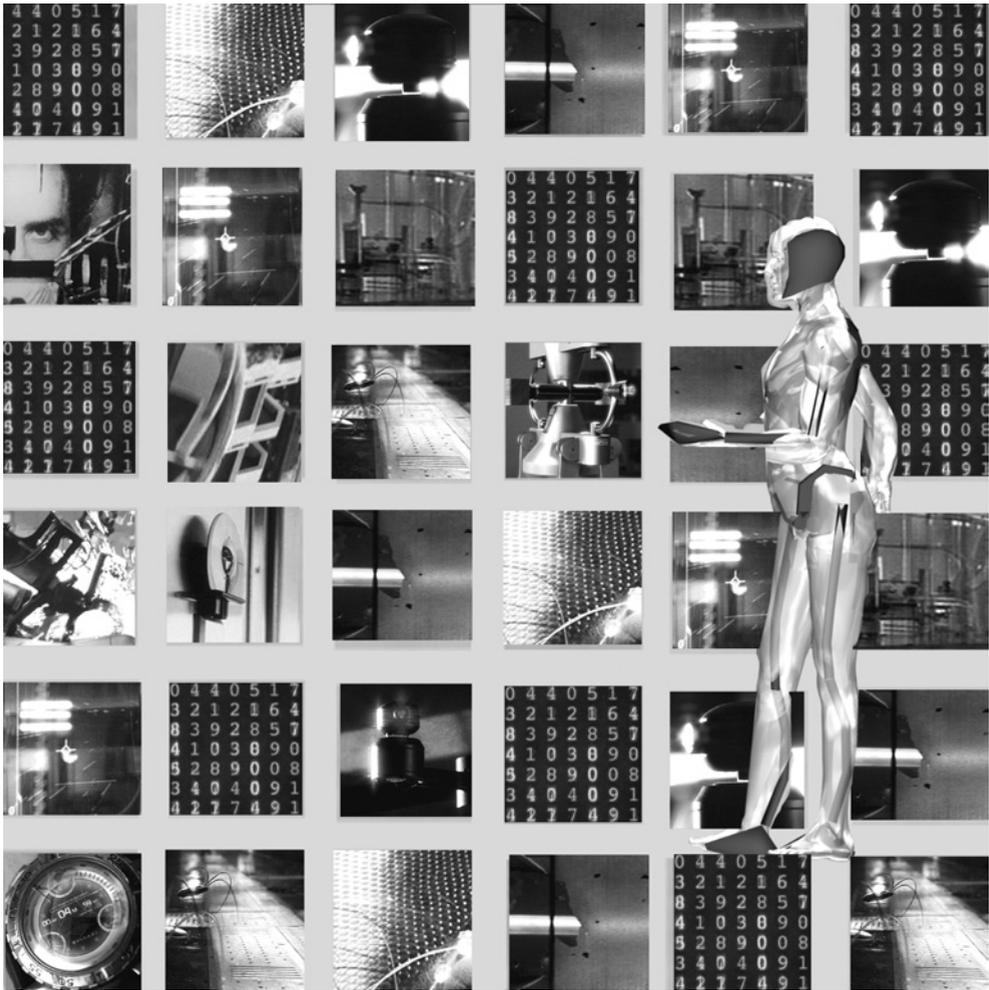
Formation as design strategy is a structured process of shaping of the space, addressed to the biological concept of the individual. Space becomes a sensory and kinetic extensions of the human body, forming the invisible framing – a spatial bubble around it, which harmonizes with the motion of the body, the sphere of kinaesthesia. Architectural forms inspired by the process of formation in contact area with body are the derivative of its shape and its kinetic features.

Architectural form as the expression of the human body (*third skin*, Hundertwasser [15]), relates to its physical structure (skin, skeleton and internal organs) or to the concept of dress, covering the body. Form as *skin* becomes a biological organism, which can breathe, evolve and grow old. Form as *dress* becomes a wrapper for the individual's body, expressing their individuality and likings. Form inspired by the concept of wrapping can be characterized as the neutrality of package's shape in relation to its content, e.g. *Basic house*, arch. M.R. de Azúa [18]. Architectural form as the alternative skin or dress adapts itself to the human body's needs, regarding ergonomic and aesthetic requirements, e.g. *Refuge wear*, arch. L. Orta [18]. In this meaning, the spatial structures become either the extension of the body's limbs or the spherical bubble enveloping the human being.

Mobile forms take their inspirations from the movement of the body and they translate its dynamic postures into the spatial pattern language of architectural structures. These forms result from the architects' fascinations with mobility, flexibility, and liquidity of space. They express a concept of architecture as *motion and flow*, defined by Archigram [4], which found its continuation in current digital architecture. Forms generated by dynamic forces imprint the trajectories of movement in the structural substance, e.g. *Ether*, arch. DECOi [22]. Mobile forms, correlating to the human being's body, often generate additional response and body's movements, e.g. *Turnon*, arch. AWG [18].

## **3. Interactive structures: reflection about the artificial intelligence of architectural form**

*in*Formation as design strategy is a structured process of shaping space in relation to the biotechnological human body, equipped with electronic devices and sensors. Space is treated as a digital extension of the intellectual potential of the individual [9, p. 52–58]. Space becomes intelligent thanks to its saturation with electronic devices, peripherals, and interactive technologies. Extending the consciousness of the built-environment or granting artificial intelligence to architectural objects can be realized in different ways, from concept of forms as machines to info-media, interactive or illusory forms.



III. 1. *Robo sapiens* in augmented reality (image by author)

Forms as machines are created according to the fundamental principles of mechanics. They are subordinated to such aims as: simulation of movement of structural elements, introduction of an active time factor to architecture, and energy conversion, e.g. *Portable House*, arch. Philippe Gregoire, Claire Petetin [1]. Spatial patterns shaping the mechanistic forms are connected with an acceptance of certain assumptions of the necessity of: gaining energy from alternative natural sources and designing the circulation of a closed energy system in a structure, inspired by the idea of *perpetuum mobile*, e.g. *Intelligent House*, arch. K. Sakamura [16, p. 35–40].

Info-media forms operate on artistic expressions taken from the language of electronic media; a language which is based on the active power of information. Space becomes a medium between sender and receiver, emitting bits of information and images, e.g. Schauberg

DuMont, arch. J. Nouvel [12]. Shapes of architectural forms seemingly disappear because of the screens' omnipresence. The only messages from media facades manifest in space, which allows the users to express their own narrations, manifestoes, or aesthetic preferences.

Interactive forms are based on different game strategies, which make possible interactive communication between users and architectural structures on different levels of complexity. The experimental forms are characterized by the use of interactive walls, screens or membranes, e.g. *Aegis*, arch. dECOi [22]. Interactive forms, saturated with information and electronic devices, make it possible for users to steer the work of the structures, to interact with other users, or to travel in the virtual world, e.g. *Media Galaxy*, arch. MVRDV [11].

Illusory forms come into existence within the concept of virtual reality, e.g. *Virtual New York Stock Exchange*, arch. Asymptote [1]. Illusory space can be reduced to a machine emitting holograms, which are the expression of any structures in three-dimensional space. According to the diagnosis of Marcos Novak, relating to directions of development of future architecture, form will follow fiction, not function (*form follows fiction* [13, p. 43–47]). In illusory space, forms can change their own expressions with no limitation; they can appear or disappear thanks to use of new technologies, e.g. optical camouflage, hologram, or stereoscopic projections [19], making it possible for users to live in a virtual, illusory space, e.g. CAVE, and i-CONE [21, p. 344].

#### **4. Metamorphic forms: reflection on the limits of formation**

*trans*Formation as design strategy is a structured process of shaping space in relation to the trans-biotechnological, hybrid human body, connected with interference into the genetic code – algorithm of the spatial structures. Architectural form is treated as a variable state of structural organization in the topological space. In this way of thinking, games with space-time reach furthest, raising fundamental questions about the limits of formation, keeping intellectual discipline, or the criteria of architectural valuation. *trans*Formation as design strategy leads to creation of sequences of metamorphic, convertible, transgenic, generative and animated forms.

Metamorphic form is characterized by structural transformations, passing from one to another state of structural organization in topological space. These processes require the application of organic materials to architecture, which allows the spatial structures to extend, transform and evolve.

Convertible forms are based on data transmission and the mutual convertibility of information, energy, matter, time and space in a multidimensional reality. The information stream, passing through the structure, causes transformation of the architectural object according to the direction of informed energy flow, e.g. *Saltwater Pavilion*, arch. K. Oosterhuis [22]. The fundamental challenge is to maintain and equalize the energy in the structure during the conversion process, e.g. V2Lab, arch. NOX [22].

Generative forms come into existence thanks to mutations in information codes and experiments with algorithms of spatial structures. Generative forms, e.g. *Data-Driven Forms*, arch. M. Novak [22], can only be realized in the case of using of nanomaterials in architecture; materials which enable access to the internal codes of spatial structures.

Transgenic forms are characterized by transformations of the substances of spatial structures as a consequence of passing through different states of aggregation of matter, e.g. *Blur Building*, arch. Diller & Scofidio [10], or in the way of modifications of internal algorithms, influencing the variability of structural substances, e.g. *Embryo house*, arch. G. Lynn [22]. These forms mean a combination of the physical components of built-environment – *urbs* – or architectural structures – *archs* – with the information codes – *bits* (*the physical urbs are replaced by bits* [14, p. 7]).

Animated forms come into existence thanks to simulation of the observer's movement. They are characterized by liquidity and non-determination of the mutual relationship between forms and context. Perception of the animated object is based on the simulation of one or many viewpoints in the space-time, e.g. *Enteractive, Electroland* [3]. Animated forms, besides the introduction of complexity in perception of spatial structures, define afresh the relations between form and context, according to which a form can transform into context, and inversely – the context can become a form, e.g. *Haptic horizon*, arch. S. Perrella [22].

## 5. Conclusions

In the era of digital design, *gametecture* – an architectural game with space-time – causes the creation of infinite sequences of spatial structures. In consequence of the inflation of forms created by simulation games, the valuation of spatial structures based on the traditional criteria of the beauty of form or logic of the structure loses its meaning because of the permanent changes and mutations of forms in time. Simulated forms are variable and transformable thanks to the flow of information, energy, and matter through space-time.

New technologies break down the barriers between place and space, creating a category of liquid fuzzy spaces and augmented reality. Nowadays, close and distant places are connected thanks to digital and time communication, and not because of spatial proximity. The liquid architectural object becomes a context for itself, while the liquid context can become an object in the continuous transformations of architectural forms [6, p. 32–41; 8, p. 62–67]. *Gametecture* blurs the borders between interior and exterior, place and space, form and context, object and process. Is there any form here?

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