

VIRTUALITY IN ARCHITECTURE – FROM PERSPECTIVE REPRESENTATION TO AUGMENTED REALITY

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Abstract. *Notion of virtuality correlates mainly to visual aspects of space, presuming that basic qualities of physical space can be simulated by graphics, providing not just visual illusion of the third dimension of real space, but psychological involvement and transfer of the spectator into the space of the picture, giving him the sense of the spatial location and presence. Creation of virtual space that could be perceptually sensed and by virtual presence modified and shaped, explored and experienced, is not just result of advanced computer technology, but could be traced through history of spatial representations, that was based mainly in artistic and architectural practice.*

Architecture, being leading field that synthesizes representation, construction and sense of spatial creation, had to be involved in explorations of multidimensional complex network of dynamic informational space, that is revealed in its real and virtual dimension as unique universe. Real-time experience in virtual space allow access in the alternative dimension to every open mind, giving him possibilities to play and work, to construct and represent, search, explore and express, augmenting reality into the complex network of information flow between visible and invisible space.

Key words: *architectural representation, information, virtual space.*

1. INTRODUCTION

By using various techniques of representation of space, architects evaluate the spatial values of their projects, and communicate with their clients and collaborators. Different stages of projects are represented on different levels of representation, from conceptual to final presentations. In architecture, objective forms of representation - orthogonal and axonometric projections as floor plans, elevations, sections, isometric views, has great importance in exact technical description, but those pictures has little possibilities of activating attention and emotional response, that is relevant in proposal of the project to the human user. They also have low potential of dynamical operation that involves more complex levels of information, including visual spatial locality and temporality.

Computer digital technology and graphics established widely a new form of space – not only representational or pictorial but virtual space. Notion of virtuality is mainly correlated to visual aspects of space, as simulation of the basic qualities of physical space by graphics. Many different styles of pictorial representations, from Egyptian, Byzantine or Chinese drawings, to orthogonal or axonometric projections in technical drawings, maintains space distance between picture space and viewer space. Representation that enables virtuality, as deeper involvement of spectator in to the pictorial space, is historically established in the period of renaissance, through linear perspective graphic representation of space. That particular kind of picture creation includes pictorial spatial representation, geometric abstraction and some kind of imitation of real sensory mediated visual space. Perspective drawing as graphic space representation, includes the real and virtual dimension of space, not only by visual illusion of the third dimension of physical space, but providing some kind of psychological involvement and transfer of the spectator into the space in the picture.

2. RENAISSANCE INFORMATISATION AND SUBJECTIVISATION OF SPACE REPRESENTATION

Foundation of perspective drawing science in the Renaissance is joined to the interest in natural laws that regulates the world, and to phenomenon's of vision and optics. During the Renaissance, artists developed means of recording optical views, with the help of mechanical instruments and geometric constructions. By the means of projective laws, real spatial objects were decoded and transformed onto a two-dimensional surface by linear perspective. Perspective invention described the logical construction of space based on rational principles of its optical formation. The Renaissance architects and artists invented way to observe infinite decentralised space, by means of rational space frame, and to be oriented in it by some distinctive, individual, subjective point of reference. First accurate perspective construction is attributed to architect F. Brunelleschi [1].

Perspective invention as a method for creating representational, pictorial space that somehow provide to eye impression of full third spatial dimension, is often viewed as illusionistic rendering techniques that simulates natural vision. This viewpoint is now changing, with the increasing interest in development and properties of pictorial space, promoted by development of computer graphics and digitalisation of picture. Importance of invention of perspective, not merely as graphic illusion of the real visible space, but as universal system that reveals laws of informational equivalence between physical, visual and representational space structures, now is emphasized by development of the new scientific theories in informatics and physics science. The notion of computation, defined in abstract sense, correlates on universal level informational digits and physical systems. S. Wolfram formulated The Principle of Computational Equivalence [2] that implies, from a computational point of view, that a wide variety of systems with different underlying structures, are equivalent at some level. This principle implied that our processes of perception and analyses could be considered as some kind of computation, in correspondence to principles of organisation of different natural and artificial abstract systems. Perception, representation and construction as the key features in perspective invention, through the principle of computational equivalence could be considered in terms of computation.

Perspective representation in the light of the new scientific theories of computation, is not just illusionistic rendering techniques, but geometric code of visual information and spatial organisation, considering external location of objects and internal position of subject, thus enabling sense of virtuality, differing from other systems of representation based just on external objective properties of forms. Coding of perspective drawing is based on digital space representation and localised positions of informational points-digits. It is a system based on discrete elements and network organisation, informational complexity and transformability, virtuality as viewer interaction and some kind of his presence in alternative dimension of space. Virtualisation is based on informational equivalence, providing visualisation of complex spatial information, by construction and simulation of the dynamical relations.

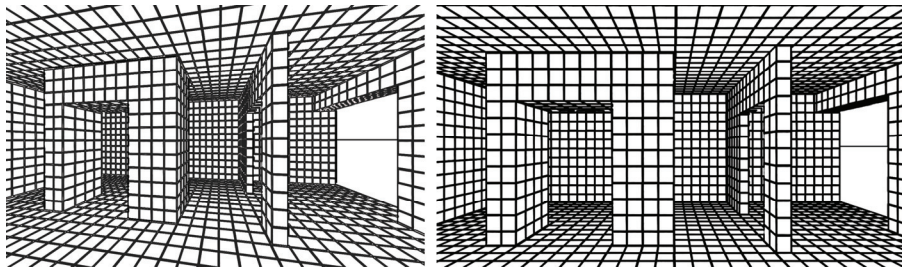


Fig. 1 Perspective as digital space representation is a network system based on discrete elements and visual location of the viewer in to the pictorial space

3. VIRTUALITY AND SPACE SENSATION

Perspective pictures sometimes are considered to be early historical introduction to space virtuality, mostly in sense that they are fake simulation of the real visual sensation of the physical space. Perspective pictures has no direct equivalence to natural visual stimulation of eye vision. Psychological and physiological character of perception are more complex than any representation on two dimension. Some art theorist and most modern artists abandoned perspective, claiming that perspective is just a mere convention of representation, rigid and lifeless geometric scheme. J.J. Gibson opposed that statement, claiming that the optic array from a picture and the optic array from a physical world can provide the same information without providing the same stimulation. It is possible to capture the information about something without replicating its sensations [3]. So perspective pictures are not pictures equivalent to direct visual retinal perception as simulated vision, and not a mere convention, but they are the pictorially mediated informational matrices that has common features with direct perception of the world. Human perception is not just mere construction, but also selection, manipulation, and creation of information data. Representational spaces that are not just static pictures, but dynamical informational systems, through coded information content provides much wider possibilities than just photo-copying of the visual features of the world.

Virtuality does not imply perfect copy of the real vision. It signify coded abstract model enabling informational integration of cognitive, sensitive and psychological

mechanisms of perception. In contemporary philosophical discourse virtuality is not just simulation of external visual data, but has more complex and fundamental qualities. Term "Virtual" derive from the Latin "virtus", meaning "potential" or "force", that is inherent in real, and it could become actual, perceptible and operative. Virtuality is not just simple possibility of reality, nor opposed to reality, but already real in themselves, while its actualization proceeds by dispersion and differentiation [4]. Original and its virtual actualizations interchange contents and transform each other. Reality is no more singular state, but multiple and disperse phase space. "Reality" and "virtuality" exist in common matrices. By constraints of physical environment, the "real" events happens in singular time and place. In opposition, "virtual" refers to multiplicity and diversity of places and times. Multiplicity of reality is implied in virtuality reality. As its hidden, inherent features, virtuality is a creative conceptualization of reality, actualized through various modes of differentiation. Actualization of virtual is a new creation, not the simulation of previous and predetermined possible forms of existences. Virtuality as "phenomenologically descriptive of the extreme complexity of experience" [5] becomes generator of forms, implying affirmation of the unexpressed, hidden forces by which reality is constituted.

Informatics virtualisation synthesize visible and invisible information, actual and potential dimension of reality, possibility and creativity of imagination and representation, based on informational equivalence of different levels of spatial organisations. Virtual reality is concept that includes many different aspects of activity, manipulation and remote presence, through different modes as simulation, interaction, artificiality, immersion, telepresence, full body immersion and networked communications [6]. For K.Veltman "virtual reality is the best means of externalizing the contents of the mind, an ultimate tool for exteriorization, for perfecting the extrovert." [7]

Involvement and transfer of the spectator into the space of the picture by informational and functional isomorphism to reality is giving him the sense of the spatial location and presence in alternative dimension. Virtual environments create a sense of immersion within a computer model, satisfying the criteria for the perception of motion and space, not just on perceptual sensory level, but on psychological level, enabling transition in virtual cyberspace by developing a sense of actually being present inside the model. Telepresence is the mental projection of the body in to other spatial location and dimension, subjectively displacing participants to real or imaginary remote locations as active spatial mental involvement in alternative space. Some distinctions have been made between the psychological and full sensory immersion in virtual reality provided by advanced technological devices, but they both have basic common property that they transubstantiates, and does not imitate real world [8].

4. VIRTUAL ARCHITECTURAL SPACES AND AUGMENTED REALITY

Virtual reality and virtual environments in architecture becomes a synonym for computer generated 3d real-time graphic environments. 3D real-time computer environments provides representation more equivalent to natural sensory space perception through interactive media and motion involved in representation. Contemporary digitalized virtualization enables not just a form of tele-presence as remote presence, but simulation of some dynamic changes in virtual environment. Virtual environments enables sense of

movement of spectator by changing direction, path and speed of visual field changes. To get virtual qualities representational picture does not have to be photo-real by perfect simulation of textures and light effects, but to have balanced relations of external and internal picture references, guiding attention and giving possibilities of dynamical information, interaction and operation. Virtual reality in architectural representation is used to visualize complex information of object construction and form, to simulate different variants of design, or to simulate and explore other dynamic data of building development, as lightning, thermal or acoustic conditions.

Virtual reality is today evolving from 3d previously planned computer animations, as passive perceptual experience of designed space, to interactive exploration. Real-time computer graphic visualization enhance the representational possibilities, enabling not just visual information, but providing to user direct involvement, interaction and exploration of the created space, in preliminary and final project phases. Performing in virtual space includes not just reality-related cinematic, but also actions and experience that is not possible in reality [9] (walking through walls, flying through and above architectural objects.) In virtual environment, physical bodily constraints could be removed and communication could be shared with distant participants on different locations.

Tele-presence as transfer to virtual reality implies that during the immersion in the virtual space, user somehow excludes himself from real space. Development of the tools that allows visual synthesis of the real and virtual objects provides new possibilities of mixture between real and virtual environment. Mixed or augmented reality is the new field of research and application of virtuality in real -time actuality, that provides unique sense of real experience, that allows coexistence of virtual and real space objects. Augmented reality supplements some part of reality with virtual elements, remaining a user's sense of presence in the real world [10]. Real and virtual objects interaction enhances users perception of the real, by displaying additional information to his senses, and helps to perform specific tasks in the real world environment [11].

Implementation of virtual and mixed reality in architectural spaces as the interplay of physical and virtual world, includes in architecture new kind of spaces, without concrete and conventional spatial elements, boundaries and landmarks [12].

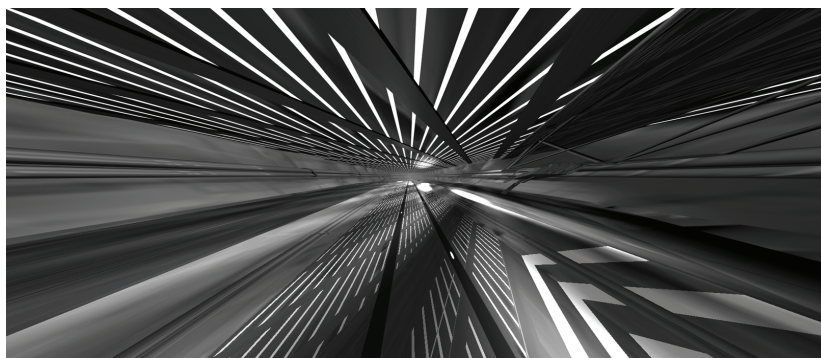


Fig. 2 Extension of perceptual and mental experience, by active spatial involvement in alternative space dimensions, expands creative imagination.

5. CONCLUSION

Virtuality is not just advanced media product that enables representation and simulation of reality by perfect pictorial imitation, but expansion of informational pictorial space conceptions, that could be find through history of representations, from perspective invention to contemporary digitalized real-time remote operation. By extension of perceptual and mental experience, man expands domain of creative imagination. As the result of information processing potential and enhance of human perception experience, real-time experience in virtual space allow access in the alternative dimension to every open mind, giving him possibilities to play and work, to represent and construct, to search, explore and express.

Virtual reality and virtual architecture could be just part of conceptual or representational level of project development, but also becomes active part of the real physical architectural space. Explorations of possibility of virtuality demands further investigation, and architecture, as in past being leading field that synthesize representation, construction and sense of spatial creation, had to be involved in explorations of multidimensional complex network of dynamic informational space, that is revealed in its real and virtual dimension as unique universe. Rationality of reality that was foundation of modern architectural space, now is changing in to complex, dynamical, virtual informational matrices of the reality, that reveals different, multiplied actualizations. Virtuality in architecture changes reality and opens new dimensions of architectural spaces, in complex network of information flow between visible and invisible space.

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VIRTUELNOST U ARHITEKTURI – OD PERSPEKTIVNE REPREZENTACIJE DO PROŠIRENE REALNOSTI

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Pojam virtualnosti povezan je pretežno sa vizuelnim aspektima prostora, pretpostavljajući da osnovni kvaliteti fizičkog prostora mogu biti grafički simulirani, pružajući ne samo vizuelnu impresiju treće dimenzije realnog prostora, već psihološko uključivanje i prenos posmatrača u prostor slike, dajući mu osjećaj prostorne lokacije i prisutnosti. Kreiranje virtuelnog prostora koji se može perceptualno osjetiti i virtuelnom prisutnošću modificirati i oblikovati, istražiti i iskusiti, nije samo rezultat napredne računarske tehnologije, već može biti istraženo kroz istoriju prostornog prikazivanja, zasnovanog uglavnom u umjetničkoj i arhitektonskoj praksi.

Arhitektura, kao vodeća oblast koja sintetizira reprezentaciju, konstrukciju i osjećaj za prostorno stvaranje, mora biti uključena u istraživanja multidimenzionalne kompleksne mreže dinamičkog informacijskog prostora koji se otkriva u svojoj realnoj i virtuelnoj dimenziji, kao jedinstven univerzum. Iskustvo u realnom vremenu u virtuelnom prostoru dopušta pristup u alternativnu dimenziju svakom otvorenom umu, dajući mu mogućnosti da se igra i radi, konstruiše i prikazuje, traga, istražuje i izražava, proširujući realnost u kompleksnu mrežu informacijskog toka između vidljivog i nevidljivog prostora.

Ključne riječi: arhitektonska reprezentacija, informacija, virtuelni prostor