Fluid Urbanism

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Abstract. This paper reviews the futuristic approach to urban planning – Fluid Urbanism. Research focuses on case cities of London, Istanbul and Turin (Torino) to reveal the theory and practice behind approaches to design in a before unseen ways, using parametric animation software and programmed scripts. This enables to keep the surrounding urban context untouched, implementing new grids and systems in the city fabric, seamlessly designing by new strategies in architectural design. Author explains his own project, revealing details of 3D modeling and animation with fluids to obtain the desired result – contemporary master plan in an existing urban surrounding.

Keywords: animation, fluid urbanism, liquid architectures, scripting, three-dimensional modeling.

Introduction

People have been designing our World since the times of the Ancient empires. The utmost accumulation of design in a broader scale is being seen as urban architecture. Historically, also the theories behind urban planning have been developing, but still architecture is one of the slowest to be moved along with the latest achievements in all other design industries. The reason for it is the scale and existing built structures in contemporary cities. Most large developments have happened during dynamic booming of economies. We must also be aware that incredibly complex processes of artistic expression, politics, finance, as well as most public and private interests nowadays affect any design decision. According to Karl Chu (as he said in lecture on February 29, 2008 at UIC ESARQ, Barcelona), the founder of theory on genetic architectures, we have exhausted what we have been doing.

We have somehow limited the boundaries of what architecture is. Luckily, a number of architects are pushing the boundaries of contemporary architecture well into the future. Some are working on the mathematical and technological levels and others are working on philosophical and esthetical ones. Whatever the stage, they are exploring possibilities for architecture never ventured before. Some of them undertake projects that are a long way from realization but they manage to widen our architectural horizonts [1]. Using the latest contemporary computational systems designers are trying to expand the field of architecture. To understand the reasons of this being happening, one must look in a broader scale how architecture has started to become mixed up with other design fields.

Long time architects have been tied to their tools – drawing boards, rulers etc. Since the age of digitalization not only the speed of an architect's work but also results of his work have changed a lot. We have been overwhelmed with developments in many industrial fields that shows us there are much more aspects that influence architecture as well. Architecture nowadays links to and can be linked to almost anything. The thrill of controlling form in a way computers can do it has become spectacular. Either way, directions to new form-finding, mostly inspired from nature and decoding its processes have been around for almost a century, but only now in recent technological age of digital tools these ideas are being carried out in an unseen and sometimes scandalous ways.

Pioneer of the Architecture Virtuality

Architect Marcos Novak, graduating from Ohio University with a specialization in computer-aided architecture, has remained faithful to his field. He has managed to convey his futuristic ideas wherever he could. His work has been essentially virtual. It is so advanced in this field that he is regarded as the "pioneer of the architecture virtuality" according to the organizers of the international Architecture Exhibition in Venice. He is known for projects, which in their name give hint that they consist of a futuristic element (Fig. 1). "Sensor Space", "Transmitting Architecture", "Liquid Architectures", "Metadata Visualization", "Echinoderm", "AlloBio" and "Alienwithin" just to name a few. Marcos Novak became the most visible proponent of cyberspace as an autonomous architectural field of inquiry. His greatest achievement is his use of non-Euclidean spatial concepts with the idea of algorithmic unfolding, that is, mathematical modeling of data space navigable computer environments to create unexpected futuristic forms.

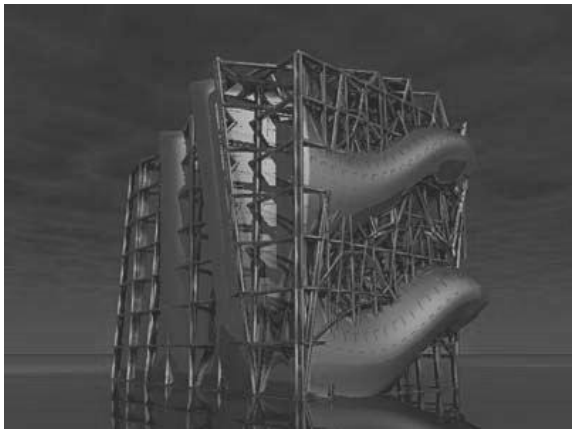

Fig. 1. Paracube, a six parametric surface conceptual object by Markos Novak, designed in 1997 [2]

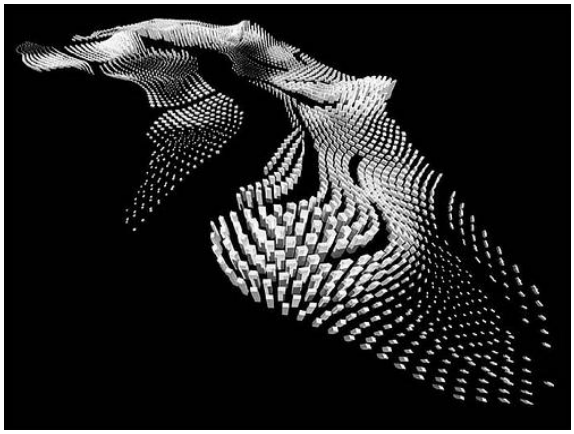

Fig. 2. Large-scale urban development on river Thames estuary, London [3]

In other words, the animated mathematical forms created in the virtual reality by Marcos Novak, derive from the manipulation of mathematical fields. All these technical terms mean that throughout his immense body of work he attained forms that are "out of this world". Forms, which resemble some neo-biological creatures floating in the extraterrestrial seas, or science-fiction beings roaming the universe. Marcos Novak's liquid architecture seems to combine the opposite, soft with hard, real with virtual, masculine with feminine and mathematical with poetical, to create third or "alien" condition. He seeks nothing less than warping into alien territory, into unpredictable conceptual spaces, into new states of being of the future.

Back in 1995 in an interview [2] with Marcos Novak, he was asked: "As opposed to literature and music, the architectural milieu is extremely academic. What kind of sentiments are dominant regarding your and others' talk of these liquid architectures? What kinds of critiques are coming out against you?" He replied: "Indeed, architecture has been the slowest to respond. I regret to say this, since I love architecture, but it is true. To be fair, though, there are at least two architectures, the architecture of accommodation, and the architecture of excess. Accommodation produces buildings, excess produces "Architecture". This is not a question of extravagant expense, but one of vision and generosity. The architects of excess have always been leading visionaries of their times. The trouble is that we live in a world where accommodation outnumbers excess and generosity, as training outnumbers education and learning. I have had to fight with this all my life, and I expect that this will not change, since I am committed to keeping myself open and agile. The critiques are predictable and banal, on the order of "this is not architecture". What is worth noting, however, is that the critiques do not change: the same fears are articulated again and again, true to the tiresomeness of the thinking behind them, with only the name of the "enemy" changing. The fear of computer-aided design has been replaced by the fear of cyberspace, but the negative rhetoric is identical. If I had a few more lives to spare, I'd write a history of fears. It would be very unimaginative, tedious, and repetitive [2]." Extending these ideas to urban planning gives us architecture, which blends in, weaves together, expands, syncs, contextualizes, interferes and dialogues with the city canvas. In other words it may be referred as Fluid Urbanism.

Examples of Fluid Urbanism

Big architectural firms design in expressing the utmost accumulation of capital and its vast influence over the traditions. This can be best seen in urban design. New inter-disciplines arise and the canvas of old historical sites is being opened up to new fields of experimentation.

Form Informing Urbanism - Parametric Urbanism is an animated film created by Zaha Hadid Architects for the Global Cities exhibition at museum Tate Modern in London. The film presents a range of experimental design solutions for the Thames Gateway regeneration corridor to the east of London, based on parametric techniques pioneered in urban planning by Zaha Hadid (Fig. 2).

Architects Zaha Hadid and Patrik Schumacher have chosen the Thames Gateway as a testing ground in which to evolve new ways of approaching large-scale urban developments. The Thames Gateway is an area stretching eastwards

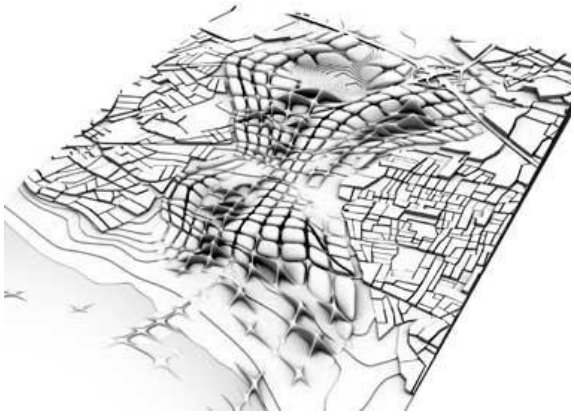

Fig. 3. Kartal-Pendik master plan [4]

from East London on both banks of the river Thames; it has been hailed as Europe's largest urban regeneration project. Driven by architectural rather than town-planning concerns, Hadid and Schumacher have used a series of new and powerful digital design techniques to develop an approach to urban regeneration which they call "Parametric Urbanism" [3].

Another great example is the Kartal-Pendik master plan, a winning competition proposal for a new city centre on the east bank of Istanbul (Fig. 3). It is the redevelopment of an abandoned industrial site into a new sub-centre of Istanbul, complete with a central business district, high-end residential development, cultural facilities such as concert halls, museums, and theatres, and leisure programs including a marina and tourist hotels. The site lies at the confluence of several important infrastructural links, including the major highway connecting Istanbul to Europe and Asia, the coastal highway, sea bus terminals, and heavy and light rail links to the greater metropolitan area. The project begins by tying together the basic infrastructural and urban context of the surrounding site. Lateral lines stitch together the major road connections emerging from Kartal in the west and Pendik in the east. The integration of these lateral connections with the main longitudinal axis creates a soft grid that forms the underlying framework for the project. Locally, this net can be bundled to form areas of higher programmatic intensity as well as a vertical build-up of the city fabric. In certain areas the net rises up to form a network of towers in an open landscape, while in other areas it is inverted to become a denser fabric cut through by streets, and at other times may completely fade away to generate

Fig. 4. Aerial view of the master plan, indicating the post-Shanghai Expo proposal for the site [5]

parks and open spaces. Some areas extend out into the water, creating a matrix of floating marinas, shops, and restaurants. The fabric is further articulated by an urban script that generates different typologies of buildings that respond to the different demands of each district. This calligraphic script creates open conditions that can transform from detached buildings to perimeter blocks, and ultimately into hybrid systems that can create a porous, interconnected network of open spaces that meanders throughout the city. Through subtle transformations and gradations from one part of the site to the other, the scripted fabric can create a smooth transition from the surrounding context to the new, higher density development on the site. The soft grid also incorporates possibilities of growth, as in the case where a network of high-rise towers might emerge from an area that was previously allocated to low-rise fabric buildings or faded into open park space. The master plan is thus a dynamic system that generates an adaptable framework for urban form, balancing the need for a recognizable image and a new environment with a sensitive integration of the new city with the existing surrounds [4]. The Kartal-Pendik waterfront regeneration plan is Turkey's most important urban infrastructure project ever undertaken. Covering an area of 3.5 million sqm in eastern Istanbul, it is also one of the largest developments of its kind worldwide.

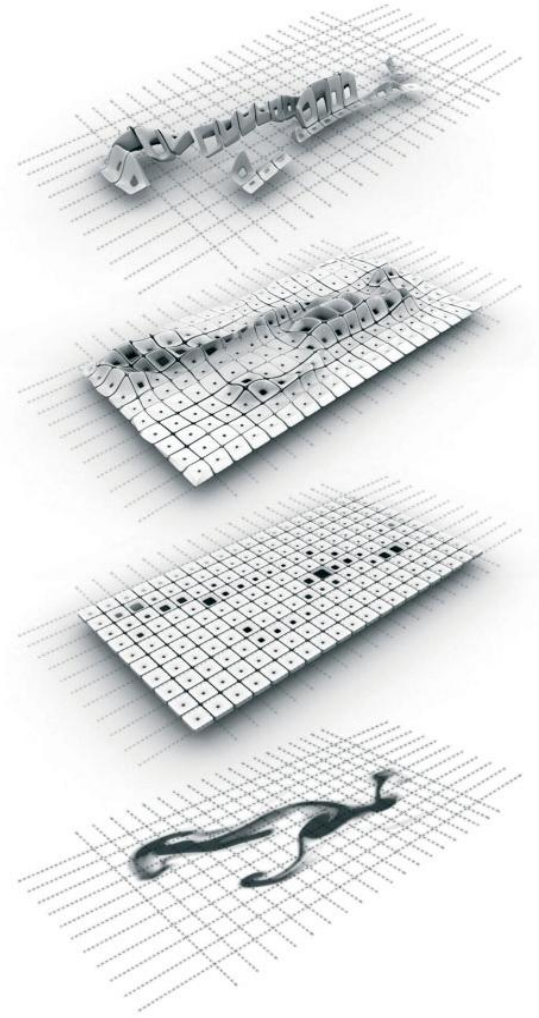

Fig. 5. Series of diagrams describing the design development of initial fluid simulations in Maya [5]

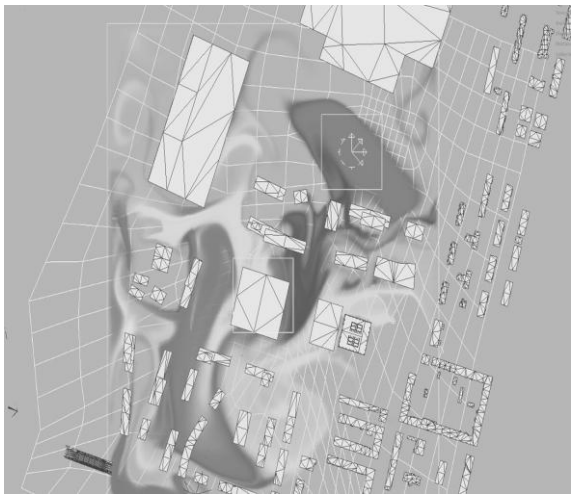

Fig. 6. Virtual fluid simulation defining building typologies [Source: authors' visualizations]

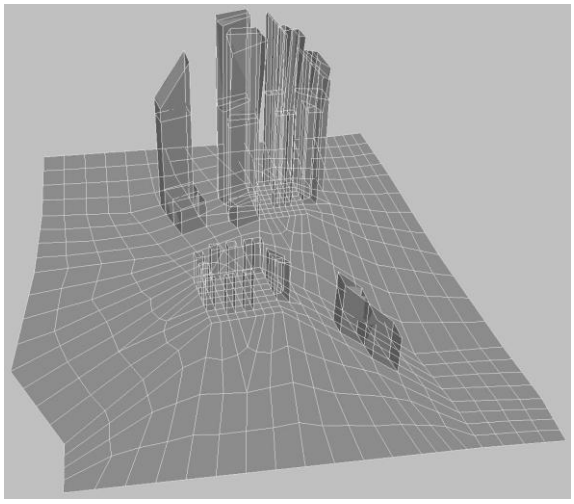

Fig. 7. Vertical elevation of high-rise structures [Source: authors' visualizations]

Academic Experiments and Approaches to Fluid Urbanism

Design Research Laboratory at Architectural Association, London has been the leading research base for experiments related to Associative Urbanism [5]. One reason for that is the presence of Patrick Schumacher as a design tutor in the laboratory. In a joint student group they have developed a master plan proposal for the post-Shanghai Expo, once the international exhibition will be over and temporary structures removed (Fig. 4). The design includes three primary architectural typologies – fields of differentiated towers; low density yet permanent Expo and cultural facilities; and landscape spaces, also reserved for further development. Design development was obtained with fluid simulations in Maya (Fig. 5), followed by successive stages of design development and post-production scripting and modeling, increasingly resolving and refining the model as a design proposal informed by other spatial, structural and circulatory parameters.

Author has participated in an international biennale "Advanced Architecture Settimo Tokyo" workshop "Design with Maya, MEL script and plug-in", held in Italy, in June 2009. In the final design task author made an academic cooperation project with Matteo Lo Prete, an architect from Italy to design an addition for Torino Lingotto master plan, originally designed by architect Massimiliano Fuksas. Workshop tutors represented two leading project architects of Zaha Hadid Architects, London – Fulvio Wirz and Ludovico Lombardi.

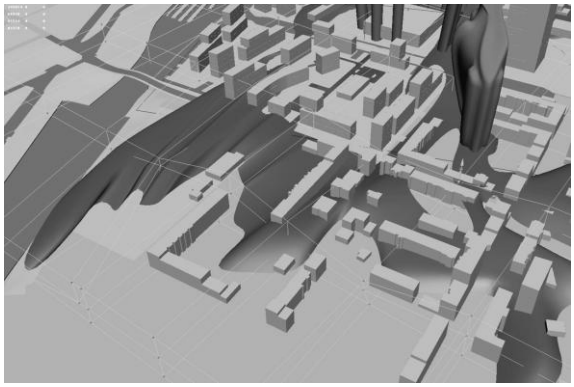

Fig. 8. Secondary control grid revealing landscape architecture details [Source: authors' visualizations]

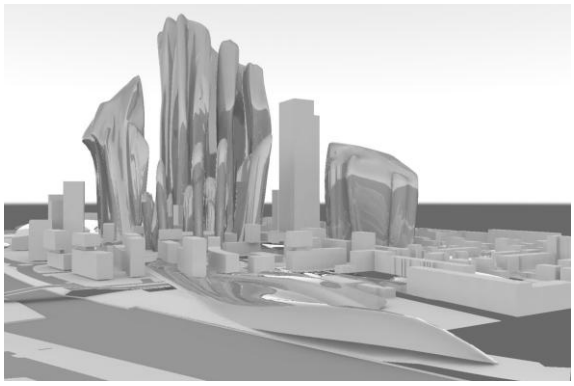

Fig. 9. Final rendering of Torino Lingotto master plan addition [Source: authors' visualizations]

Design involved several consecutive design steps and lots of modeling, programming scripts and setting parametric relations. Whole task was to experiment and find if there is any limit of possibilities in Fluid Urbanism approach using latest computational tools and theory behind generative design. Initial stage was to import existing urban canvas and street network of the Torino Lingotto area as a 3D model. After that, a new grid was formed which later on will be used to manipulate geometries and affect unexpected form solutions, obtained by previously defined and set-up design decisions. At this point authors set up programmatic rules for virtual fluid emissions in various colors that would define how the programmed script would express building typologies (Fig. 6). Three main zones were chosen and defined: blue – high-rise area, red – low-rise area and green – park area. The zones were chosen manually only defining the emission points, regarding future needs for them in the context of the planning addition. The emissions were calibrated so that they disperse in the territory taking into consideration existing built structures as obstacles to flow around them.

Authors then programmed a behavioral script that would stretch and squeeze previously set up grid to correspond the emitted flows. The new grid with its structures and street network seamlessly continued to surrounding blocks of the city leaving no traces of joining points, because any transformation that was happening inside of the new grid was still linked to surrounding area. Once the grid was animated and the right variant chosen from the sequence of possibilities that, according to authors, suited the best – vertical elevation of new structures was modeled (Fig. 7). New high-rise buildings were adjusted to fit in major viewpoints and panoramic silhouettes. Authors did several smoothing operations and modeled the high-rises to suit aerodynamic and esthetic conditions, whereas lower level of the grid was converted into landscape architecture (Fig. 8). As authors made a decision to run all traffic underground, this decision freed up whole street level to pedestrians allowing new park structure to flow into area.

This experiment has proven that Fluid Urbanism approach may be obtained with various computer tools that derive from non-architectural fields. Today we can handle urban dynamics in animation softwares that have been developed for the use in Hollywood and other movie industries. Cleverly linking contemporary theories and visualization possibilities we may come up to the extension of the classic urban planning, that is being slowly pushed into futuristic trends and new horizons. In the design process of Fluid Urbanism there are practically no limits.

We may already say that architects have a great influence on cities that evolve and are in constant developments towards the needs of modern society. Urban planning architecture is gaining a new horizon and becoming a playground for new possibilities we never thought about before, rejecting the tired standards reserved for building and compels us to reflect on the architect's role as it is being reprogrammed by technical evolutions [6, 134]. Fluid Urbanism is ultimately balanced between radical progress, considered inquiry and poetic reflection of urbanization.

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Kopsavilkums. Liels skaits arhitektu mūsdienu arhitektūras robežas ir paplašinājuši tālu nākotnē. Visaugstākās pakāpes projektēšanas koncentrācija plašākā mērogā var tikt apskatīta kā pilsētplānošana. Markosam Novakam ir izdevies aprobēt savas futūristiskās idejas visur, kur vien iespējams, pēdējo divdesmit gadu laikā. Viņa darbi bijuši fundamentāli virtuāli un viņu uzskata par arhitektūras virtualitātes aizsācēju digitālajā laikmetā, runājot par "amorfajām arhitektūrām" un citiem futūristiskiem kibertelpas projektiem. Arhitektūra, kas saplūst, saauž kopā, paplašina, sinhronizējas, kontekstualizē, iejaucas un ir dialogā ar pilsētas audeklu. Citiem vārdiem sakot – integrētā pilsētplānošana (Fluid Urbanism – angļu val.) jau pieņemta lielākajos arhitektu birojos, izpaužot maksimālo uzkrāto kapitālu un tā plašo ietekmi pār tradīcijām. Autors apraksta integrētās pilsētplānošanas piemērus, kurus īstenojuši Zaha Hadid Architects Londonā un Stambulā, kā arī akadēmiskos eksperimentus, kas veikti Londonas arhitektūras skolas Architectural Association projektēšanas pētniecības laboratorijā, un savus eksperimentus Turīnā, Itālijā. Pilsētplānošanas arhitektūra atraida nogurdinošos standartus, kas paredzēti būvniecībai, un liek mums pārdomāt arhitekta lomu, kura tiek pārprogrammēta līdz ar tehnisko evolūciju.