ARCHITECTURAL ATMOSPHERE IN THE AGE OF COMPUTATIONAL SIMULATIONS: THE CASE OF *PRE-CONSTRUCTED* SPACE

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ABSTRACT

This paper argues that the age of computation has significantly changed the meaning of architectural atmosphere. Instead of it being regarded as metaphysical and essentially obscure, it is now possible to precisely simulate any sensorial qualities of space via architectural visualization tools. The new digital media can enable architects to understand the physics of invisible spatial processes, such as light scattering, vapour dispersion or material behaviour at microscale level. Advanced software packages, such as 3dsMax and V-Ray, based on the logic of real-life phenomena, are capable to precisely simulate any hypothetical real-life situation, in this way operating as an invaluable asset to the creative powers of human mind. While *pre-constructing* a specific spatial atmosphere, the design process goes far beyond mere three-dimensional modeling, towards understanding the connection between invisible atmospheric phenomena, spatial configuration and applied materials. It is a commonly known fact that our senses have a memory of their own, which means that our mind is capable to reconstruct a complete multi-sensorial experience from a single photograph. But, how do we *pre-construct* sensorial qualities of the images we create, of spaces that only exist in our minds, that are yet to become real? How do we produce digital atmospheres? The newly found precision in digital representation tools requires far greater consciousness over the architecture we create, which means significantly increased accountability for our own ideas and the decisions we make as architects.

BIOGRAPHY

Anđela Karabašević is an architect with a background in mathematics, and a PhD student at the Faculty of Architecture in Belgrade, Serbia. Her research is focused on the phenomena of architectural atmospheres, the production of atmospheres and a scientific basis for atmospheric processes. With her colleague Vladislav Sudžum, she has actively been involved in a number of architectural competitions and exhibitions.

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INTRODUCTION

Can spatial atmosphere radiate from a photograph? Can visual information evoke the feeling of warmth, or the smell of lime? Human senses have a memory of their own, meaning that we unconsciously collect data from our environment all the time. Our mind keeps track of our experiences, it connects situations and our emotions with characteristic smells, sounds, lights, temperatures or air flows, while building up our ability to reconstruct situations and moods even when devoid from certain sensual stimuli. A photograph of a historic thermal bath feels like something more than a mere visual sensation, its dimly lit interior arouses emotions of peacefulness and intimacy. One can almost feel the sweet and musty smell of incensed air, the sounds of splashing water, droplets of sweat on the skin, and heated stone under one's feet. It seems as if the walls of the bath are sweating with exhaustion, releasing the moisture into the warm currents of steamy air. When compared to the photograph of Crystal Palace in Madrid, even though one can track slight traces of geometric similarity, the overall mood that this bright and airy space emits is entirely different. As opposed to softly lit intimate space within the massive walls of the Kiraly Baths in Budapest, we are faced with extreme exposure, sharp shadows and bright surfaces, while the lightness of the structure seems to fade into the nature around it. The air of this crystal garden is hot, dry and still, as if burning in the sun under the heated glass. Both photographs evoke so precise and holistic emotions that one could almost predict the experiences of an immediate, direct encounter with these spaces. We know how thermal bath or crystal garden would make us feel,[1] which shows an immense power of a single image - of the amount and complexity of detailed information it contains. We usually unconsciously register and process this data, only for it to be revealed to us afterwards, as a holistic emotion, a mood evoked by the perceived atmosphere.

Photo 1. *Király Thermal Bath*, Budapest (built in 1565) and *Crystal Palace*, Madrid (built in 1887)

THE QUESTION OF PRODUCTION: TOWARDS DIGITAL ATMOSPHERES

If a photograph can emit spatial mood and trigger emotions, does it mean that a digitally produced image of non-existent architecture can convey its imaginary atmosphere to the outside, real world? Can computer generated images cause real corporeal and mental response? Even though the term *atmosphere* is commonly used in everyday language, it somehow seems to escape our understanding. It refers to the overall mood of a space, or a situation; to something indeterminate, but overwhelming; subjective, yet shared by all beings affected by it. We might say that *atmosphere* signifies all the elusive, obscure, inexplicable qualities of a space, or a situation within a space. It is conditioned by a specific spatial setting where it occurs: *atmosphere is a product of all intermingled spatial elements mutually reacting with each other.* Sensibility to atmospheres could be considered a classic ability of architects - our *superpower*, so the production of characteristic spatial moods is thus an essential architectural task (Zumthor, cited in Havik & Tielens 2013, p.59). Due to the indeterminacy of atmospheric phenomena, and complexity of spatial behaviours, the architect observes real life and tries to predict the outcome, but he/she only sets the initial conditions, a scene for the atmosphere to unveil there in time. The more he/she notices and understands the elusive atmospheric processes, the closer he can really be to constructing the desired spatial experience. It is thus understandable to conclude that atmosphere appears to be a mutual product of both architectural precision and uncertainty of everyday life - it is only a question of which one eventually prevails. That being said, the question remains if messiness of real life can be simulated digitally, or is it completely out of our powers of imagination and comprehension?[2] The elusive nature of real life atmospheric phenomena makes digital production of atmospheres seem highly unlikely.

One of the most prolific contributors to the contemporary theory of atmosphere, German philosopher Gernot Böhme (1993) notes the characteristic intermediary status of atmospheres between subject and object. One might think that atmosphere is inextricably linked to the subjective impression of space, influenced by individual memories and modes of perception. And while it is true that atmosphere only exists if felt by a subject, at the same time it is definitely highly conditioned by a specific spatial setting. Why else are we instantly overwhelmed and seduced by the steamy atmosphere of a thermal bath, or by the serene atmosphere of a royal garden? Subjective experience of atmospheres is thoroughly explored in the phenomenological theories of German philosopher Hermann Schmitz, whose conclusions Böhme draws upon. But unlike Schmitz, Böhme (1993, p.120) primarily poses a question of the *production of atmospheres*. Instead of dealing with subjective reception, Böhme shifts attention to the modes of atmospheric production: in scenography, marketing, interior design, urban planning etc. Following this line of thinking, what is actually at stake here is the possibility of a *scientific basis of architectural atmospheres*. We might pose the same question as does American theorist Teresa Brennan (2004, p.1) in her seminal work *The Transmission of Affect*: "Is there anyone who has not, at least once, walked into a room and "felt the atmosphere"?" She suggests that when a number of people is present in the same space (for example in a cafe), and hence share the same atmosphere, a transmission of affect may take place: the affective state of one person transmits contagiously to the others, the social situation in effect changes the biological constitution of each individual (Borch 2014, p.61). This can be applied to architecture as well: we may very well say that *spatial atmosphere is susceptible to the transmission of affect*. Furthermore, if one space affects everyone in a similar way, this means that the objective, scientific basis of its atmosphere could be established, and ultimately, precisely produced. In reality this might raise a series of political questions, but here we will underline what is important for the purposes of this paper: *architectural atmospheres can be digitally produced*.

THE QUESTION OF REAL AND IMPURE

Two prominent contemporary authors, Swiss architect Peter Zumthor and Finnish theorist and architect Juhani Pallasmaa, both write about the importance of atmospheric approach in architecture (Zumthor 2006; Pallasmaa 2014). Also, they both express an amount of scepticism towards the use of computers in architectural design process, as in their view, it seems to detach an architect from the 'impurities of real life'. In a lecture held at the Centre Pompidou in May 2011, Zumthor presented several case studies using interior views of his physical models, arguing that hand-made models and

drawings have become even more important with the introduction of computers in architectural offices, because they keep architects 'close to reality'. Also, Pallasmaa states that

> *Today's computer-generated renderings appear as if they would take place in a valueless and homogeneous space, an abstracted, mathematical, and meaningless world, rather than in existential and lived human reality. The lived human condition is always an "impure" or "dirty" mixture of a score of irreconcilable ingredients.* (Pallasmaa 2013, p.229)

However, it is important to note here that neither Zumthor, nor Pallasmaa advice whether or not computers *should* be employed by architects, but rather that the *way in which they are being utilised* should be modified to include the attention to the impurities of real life. In his book *Atmospheres: Architectural Environments, Surrounding Objects*, Zumthor (2006) addresses a photograph of a Broad Street Station in Richmond, as an example of an atmosphere he admires and aspires to understand. It is a building he has never visited, it might not even exist anymore, but it is this photograph that evokes 'a beautiful, natural presence' in him, it radiates its atmosphere, and 'manages to move' him (Zumthor 2006, p. 10,11). Zumthor poses a question not about the real space, but about the *atmospheric effect that it evokes*. If the qualities of real space captured by this photographer could be reconstructed on the computer screen, it would not matter much that it is a computer generated image, since it would still evoke the same elevating moods for Zumthor. The explanation of the 'natural presence' in this photograph that he seeks lies in a precise analysis of the intangible spatial qualities and behaviours of this space, one level and one layer at a time: we would need to distinguish all the relevant factors that influence this unique ambiance in order to understand its effect as a whole.

This is exactly what the new digital media should inspire architects to do: in order to reconstruct real life situations one needs to understand the physics of invisible spatial processes, such as light scattering, vapour dispersion or material behaviour at microscale level. Advanced software packages, such as 3dsMax (Autodesk) and V-Ray (Chaos Group), based on the logic of real-life phenomena, are capable to precisely simulate any hypothetical spatial setting, in this way operating as an invaluable asset to the creative powers of human mind. While *pre-constructing* a specific spatial atmosphere, the design process goes far beyond mere three-dimensional modelling, towards grasping the connection between invisible atmospheric phenomena, spatial configuration and applied materials. However, due to the discrepancy between technological development and traditional architectural skills, computer generated images of architecture are most often deduced of its experiential qualities, and reduced to mere visual sensations or iconographic messages - they lack the effect of real life impurities. On the other hand, if understood and employed in the right way, computer technology could further develop architectural understanding of the complexities of real world. Böhme (2013a, p.95) highlights the high esteem Zumthor and Pallasmaa have for craftsmanship as one of the important influences on their atmospheric approach in architecture. They both believe that architecture should be taught classically in a master-pupil relationship, much like any classical craft. But, is it not the essence of any craftsmanship in the understanding of the nature of applied materials, and in skills that can be taught only by close observation and immediate hands-on experience? Vibrant digital atmospheres can only be constructed by such attentive and precise approach. In a sense that any pre-construction of atmosphere asks for a careful observation and supreme technical skills, architectural visualization could be considered a newly found craft, rich with immense opportunities for architects to explore.

THE BLUE CUP PRINCIPLE

> *Atmospheres are indeterminate above all as regards their ontological status. We are not sure whether we should attribute them to the objects or environments from which they proceed or to the subjects who experience them. We are also unsure where they are. They seem to fill the space with a certain tone or feeling like a haze.* (Böhme 1993, p.114)

For purposes of explaining how things within a space influence the overall atmosphere, Böhme introduces an example of a blue cup. The blueness of this cup is thought of as 'a way in which a cup is present in space and makes its presence perceptible. It is not something that is restricted to the cup and adheres to it, but as something which radiates out to the environment of the cup, colouring in a

certain way this environment' - the whole space will become a bit bluer (Böhme 1993, p.121). If instead of *colour*, we imagine some other quality of a thing, a person, or a space, such as smell, vibrancy, warmth, electric charge etcetera, we suddenly become aware of the enormous range of intermingling, radiated qualities that tune the spatial atmosphere in a certain, unique way. Human mind is not equipped to process this huge amount of data, since it is not enough to extract and understand only the most imposing factors - the larger the number of influences included, the more precise and truer the gained effect is. Computer processor, on the other hand, is made to do exactly that - process enormous amounts of data in short periods of time - which means that it could be used as a powerful tool for testing complex spatial settings and their atmospheres. We are equipped to digitally re-construct the atmospheric phenomena we observe. However, this might raise a new question: how do we *pre-construct* sensorial qualities of the images we create, of spaces that only exist in our minds, that are yet to become real? How do we digitally produce *imaginary* atmospheres?

Pre-construction of space requires profound knowledge and understanding of spatial physics and its further advanced implementation in achieving a specific spatial quality - its desired atmosphere. Much like architectural photography, it requires a skillful eye and a visionary mind in order to capture the essence of a certain space. Prominent contemporary visualization artists, such as Peter Guthrie, Bertrand Benoit and Henry Goss, underline three important qualifications for achieving atmospheric images - technical understanding of software, understanding of architecture - of the subtleties of space - and an understanding of architectural photography (Goss 2013). I believe that the common denominator of these qualifications is the essential awareness and comprehension of spatial behaviors, or *the physics of spatial atmospheres*. What is it that happens in between, in the air amidst the tangible elements of space? While analyzing Zumthor's and Pallasmaa's reflections on atmosphere, Böhme (2013a, p.99) writes about the *space of corporeal presence*. Unlike geometric space, it is based on local relationships, and atmospheric stimuli that engage the body with its environment - it is a space tuned to trigger emotions. This means that there is something in space beyond its geometry, and it is these invisible qualities that Zumthor and Pallasmaa fear to be lost in contemporary computer generated images, and what is, of course, forever kept in tactile hand-made models, or hand drawings. What I intend to show here, is that *pre-constructed* spaces go far beyond simple geometry issues, and deal with a variety of elements that "tincture" the imaginary situations and in this way produce the ethereal qualities of digital images.

Photo 2. *The blue cup principle*, computer generated images

ON *PRE-CONSTRUCTED* SPACE AND ITS AURA

Pre-constructed space is a computer generated image or an animation that resembles the qualities of real space and simulates a situation that has yet to become real, or will never become real at all. It is an intentionally constructed atmosphere, and even though it excludes immediate spatial experience, it is aimed to trigger real, physical and psychological response in an observer. The common terms employed in contemporary architectural practice, such as architectural visualization, rendering or computer graphics, are in my opinion reducing the role of this media to mere visual representation of a project, whereas I would like to emphasize its potential as a research tool in a design process, towards the multi-sensorial experience of architectural space. The essential task in pre-construction of

atmospheres is to distinguish and understand its separate constitutive elements, concrete and physical processes that determine the overall ethereal effect. Many different elements such as materiality, texture, light and shadow, even sound, rhythm and temperature are dealt with separately. Even though some qualities, such as sound, temperature or smell cannot be directly captured on an image, their influence on the spatial atmosphere can. It is all about subtleties of space: for example, high temperature and humidity might cause droplets of condensed vapour on the glass windows, or traces of steam in the air. It also induces material incandescence - surfaces might emit light when heated. In the atmospheric approach forms and volumes are analysed as generators of atmosphere as well, in a sense that form 'takes away the homogeneity of the surrounding space and fills it with tensions and suggestions of movement. The volumionosity of a thing is the power of its presence in space.' (Böhme 1993, p.121) Forms define space, reflect, direct and obstruct light. Material, tangible elements can be brought to life with the dynamics of spatial behaviours.

Böhme introduces the concept of atmosphere in aesthetic theory by acknowledging its closeness to Benjamin's concept of *aura*. Benjamin sought to determine the atmosphere of distance and respect surrounding original works of art, when compared to their technical reproductions. He pointed to the loss of aura, which was brought about by the introduction of technical means of reproduction into contemporary art production (Böhme 1993, p.116-118). However, if this technology is used to create a certain work of art, like in *pre-construction* of space, does this mean that the aura, or in our case the atmosphere of this work is forever kept? Does it mean that every reproduction becomes production, or the other way around - meaning that the atmosphere (or the aura) is inscribed in the genetic (digital) code of the image, and is impossible to be lost? It is highly probable that we might be closer to the scientific comprehension of architectural atmospheres than ever before.

IN PURSUIT OF THE AURA: HEAT, RADIANCE, DAMP

> *Aura is clearly something which flows forth spatially, almost something like a breath or a haze - precisely an atmosphere. Benjamin says that one "breathes" the aura, This breathing means that it is absorbed bodily, that it enters the bodily economy of tension and expansion, that one allows the atmosphere to permeate the self... Something like aura according to Benjamin is perceptible not only in art products or original works. To perceive aura is to absorb it into one's own bodily state of being. What is perceived is an indeterminate spatially extended quality of feeling.* (Böhme 1993, p.114, 115)

My reflections on digitally produced atmospheres were triggered by several reoccurring discussions with architects and faculty professors over the last couple of years. One of these discussions was with Juhani Pallasmaa himself, during his visit to our faculty in 2014, when thematic conversations with students were organized in a short three-day seminar. During these talks, Pallasmaa had on several occasions shown an amount of skepticism towards parametric architecture, and had argued that students should not be allowed the use of computer in early stages of their design process. However, aside from generating advanced forms, computers are an invaluable asset in simulating complex spatial processes such as atmospheric phenomena, as I have argued in this paper. I suggested to Pallasmaa that the use of computers in early stages of design might be important for these other, usually overlooked reasons - it is not just about advanced complex forms unfamiliar to the human mind, or shinning representations of ideas in the end, but primarily about the possibility of *research conducted during the design process*. Unfortunately, he was not interested to carry this discussion any further. Nevertheless, it is still my belief that simulation of real situations and precise pre-construction of imaginary atmospheres leads to deeper understanding of our own ideas. I will try to illustrate what I mean with three examples of projects realized in cooperation with my colleague Vladislav Sudžum during the last year - a thermal bath, an art gallery and a holocaust memorial museum.

HEAT

In the project for a thermal bath on the lake we wanted to create the feeling of radiating warmth as opposed to the cold and gloomy atmosphere of the surrounding muddy waters. We immersed the building into the ground, and thus positioned its roof at the same level as the lake surface: it became a new artificial beach, open and exposed to the sun, as opposed to the intimate and steamy thermal chambers underneath. This roof had turned out to be a crucial element for the atmosphere we aimed

to construct. We pursued the effect of a warm red surface of the heated concrete, the soothing grained texture under one's feet and the solid, dry and washed up mass as opposed to the twinkling flow of unsettled bathing water. The glass windows in the interior are stained with vapor from the hot humid air of the bath, and the red floor flows in from the outside, only to become more reflective, wet and polished - it is now sheltered from the decaying influence of fierce weather in the open. Every material was constructed carefully layer by layer in relation to the atmospheric effects it is exposed to: its patterns of faded color, scratched texture and traces of splashing water and wet feet; droplets of condensed vapor and tinges of dripping salty fluids extracted from moist air. Soft lights and fuzzy shadows add to the overwhelming dullness of the lake environment that the red concrete beach is supposed to instantly infuse with vigour.

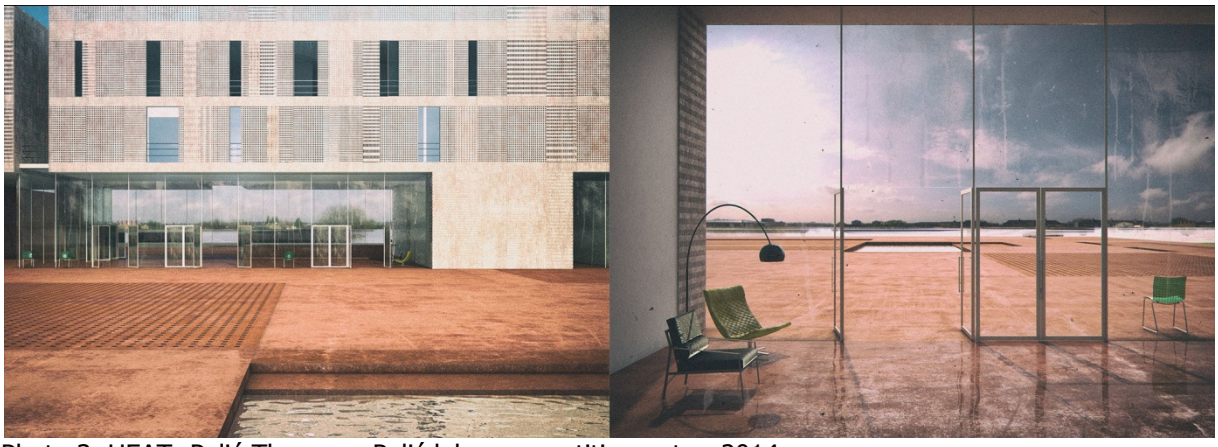

Photo 3. HEAT: Palić Thermae, Palić lake, competition entry, 2014

RADIANCE

We envisioned the art gallery as an air-tight concrete core with strictly controlled inner climate conditions for the art works, enveloped with a protective porous layer that filters the effects from the urban environment - such as direct light, noise, air currents, heat waves or unpleasant smells. The atmosphere we were seeking needed to be charged with twinkling energy. On the outside, the golden surfaces of the facade reflect the blinding sunlight onto the freshly-mown grass, and thus entirely exclude the urban life from the gallery, slowing it down for a moment or two. It is as if the building itself is radiating bright light towards its environment. In the intermediary spaces, the ambiance changes dramatically, the light is dimmed, temperatures lower, and the senses heightened. It is as if here, the emitted energies from the core and the membrane are intermingling, crashing into one another, as the bright metal reflects the white concrete surfaces, and the spotless concrete walls are stained with a mixture of leaking light and flickering shadows. The materials and lights were carefully tuned to the desired frequency. The reflection effects and the transmission of light through the membrane were essential in constructing a vibrant space of constantly fluctuating radiance.

Photo 4. RADIANCE: Aluartforum gallery, Zagreb, competition entry, 2014


Photo 5. DAMP: Museum 16/25, Belgrade, student project, 2011

DAMP For the project of a holocaust memorial museum, we aspired to gain the effect of air charged with dampness: residual moisture reminiscing the noxious and stifling ambiance of underground war shelters. The concrete structure is supposed to dry in the upcoming sun and currents of warm air, as it is meant to be revived with works of art and inflow of everyday city life. The building consists of sixteen spatially arranged and detached galleries that form a single hollowed out mass of the museum, as if it was instantly detached from the moist ground. We pursued the appearance of washed out and moldy concrete, treating it layer by layer: the orthogonal grid in its basis, traces of dirt and dripping water on the edges and reflective puddles of residual rainwater on the floors. Damp atmosphere is broken with piercing rays of bright light that manage to enter the structure from time to time.

We usually tend to imagine architecture in perfect sunshine, whereas in reality, it is constantly exposed to fluctuating temperatures, fierce winds, howling blizzards and constantly changing daily and yearly weather cycles. In all of these various atmospheres, the same building might feel completely different (Wigley 1998). The possibility to test and predict the behavior of the building in the variety of these settings even before it comes to life has an immense potential for the work of architects. In an attempt to explain his own atmospheric approach, Peter Zumthor states that

> *You have to be passionate to architecture as a real thing: the presence of architecture* [...] *I have to focus on my material, I have to understand why and when things look the way they do...* (Zumthor, cited in Havik & Tielens 2013, p. 59)

This kind of an inquisitive approach reveals a new level of genuine intimacy between the architect and his/her own work. The production of imaginary digital atmospheres requires a meticulous attention to our surroundings, and a new science of the intangible and elusive spatial behaviours. Ultimately, architecture has always really been about understanding *why and when things in space look and behave the way they do*.

CONCLUDING REMARKS

In his theory of rhythmanalysis, developed as a joint action with his last wife Catherine Régulier, French philosopher and sociologist Henri Lefebvre suggests a comprehensive research methodology of space and time based on one's corporeal awareness of the environment. Even though he does not elaborate in detail on this methodology, Lefebvre sets in motion one very important hypothesis: human senses, if appropriately trained, can be employed as a unique research instrument: rhythmanalyst uses his body as a metronome (Lefebvre 2004, p.19).

> *For him* [rhythmanalyst]*, nothing is immobile. He hears the wind, the rain, storms; but if he considers a stone, a wall, a trunk, he understands their slowness, their interminable rhythm.* [...] *An apparently immobile object, the forest, moves in multiple ways: the combined movements of the soil, the earth, the sun. Or the movements of the molecules and atoms that compose it.* [...] *The object resists a thousand aggressions but breaks up in humidity or conditions of vitality, the profusion of miniscule life. To the attentive ear, it makes a noise like*

> *a seashell.* [Rhythmanalyst] *will come to 'listen' to a house, a street, a town, as an audience listens to a symphony.* (Lefebvre 2004, p.20,25)

Lefebvre's rhythmanalysis might be an early indication of the specific kind of qualitative spatial research I have attempted to illustrate in this paper. In pre-construction of space, we go beyond mere statistical data on illumination or noise levels, towards the question of the *character* of light or sound. We want to know how space affects our bodies and minds, how does it work? What is it that we do not consciously register, but that affects our mood? Pallasmaa (2014) emphasizes the fact that our perception and understanding do not process from details towards entity, but the other way around: from entity to details. This is an essential aspect of atmosphere: it is an immediate experience of the whole, and only later can one distinguish the details that are part of it. The design process is a constant interaction between the entity and the details - and visualization software packages make this possible. We are constantly bouncing back and forth between the details and the entity, always searching for the right feeling, right mood, while constantly aware of the parameters that we control: materials, lights, volumes; it is a process of revelation and endless research, *a new way to think about space*. *Pre-constructed* space offers a human perspective, an invaluable insight into the future experience of imaginary spaces. The possibility of a precise digital construction of spatial qualities unequivocally leads to a scientific basis of architectural atmospheres. The question remains - once you have entered the world of architectural visualization and become able to see and understand what is beyond a mere image of space - are you a visualization artist, or are you still an architect? The former is constantly challenged to understand and digitally construct the real world in all its impurities and irregularities, and the later seeks to *pre-construct* imagined spaces, inspired by real life but far beyond actual reality. Where does architecture end, and visualization begin, and vice versa?

ACKNOWLEDGEMENTS

The author of this paper is supported by the PhD student scholarship of the Ministry of Education, Science and Technological Development of the Republic of Serbia.

This paper would not be possible without the contribution from my associate Vladislav Sudžum, with whom I have started working in architectural visualization field in 2012. Ever since, we have continued to improve our knowledge and skills via numerous architectural competitions and small private projects. I would like to thank him for all the inspiring discussions on the subject, as well as for the invaluable help in understanding the highly complex features of both computer generated images, and real world processes.

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[1] This might not be consistent with real life at all times, due to the vagaries of weather or changes in use. For example, the open windows of the Crystal Palace would probably make the space uncomfortably drafty, or the droplets of summer rain might briefly repress the impression of the interior heated and arid air. As for the change of use, while it was originally built to house flora and fauna from the Philippines, this array of flower scents, buzzing of insects or screeching of parrots in the 19th century is now replaced with the quietness of a contemporary exhibition hall.

[2] The question of control might be raised: the essential quality of everyday life is its uncertainty and messiness, any attempt to predict or organize it would only be devoiding it of its true nature. It is not my attempt here to say that architects can or should control real life, but that by observing it more closely they can draw many conclusions as to the way it occurs, so that they can apply this knowledge to the spatial settings they create. Computer renderings may very well be a kind of a peak hole into one of the many possible futures of architectural structures.