Advanced Constructivism and Postgravity Art: Theoretical and Philosophical Implications

Article *in* Leonardo · October 2016

DOI: 10.1162/LEON_a_01383

1 author:

Mojca Puncer
University of Maribor
18 PUBLICATIONS **5** CITATIONS

SEE PROFILE

GENERAL ARTICLE

Advanced Constructivism and Postgravity Art

Theoretical and Philosophical Implications

MOJCA PUNCER

ABSTRACT

This article discusses art's potential in outer space through a dialogue between European and Russian avant-garde traditions, and the postgravity art project by Dragan Živadinov, Dunja Zupančič and Miha Turšič. They enact a 50-year theater performance, *Noordung::1995–2045*, with the help of high tech, Suprematism and Constructivism. The performance is based on five replays every 10 years with the same actors and on technological substitutes of the deceased. The project has several topical theoretical implications. The author explores its key philosophical aspects and presents new potentialities for a systemic cognitive model for image and space conceptual transformations within the context of contemporary art and aesthetics.

Contemporary artists, who include new scientific and high-tech discoveries in their work, often use avant-garde utopian visions of Suprematism and Constructivism as their referential points when dealing with outer space and zero gravity. Constructivism in this article is represented by a little-known representative: Eduard Stepančič [1], one of the main references for the Slovene theater director Dragan Živadinov and his collaborators, the visual artist Dunja Zupančič and zero-gravity environments designer Miha Turšič [2]. The common denominator for these artists from a different era is the principle of Constructivism as a historical avant-garde principle, bringing key changes in the relation between an art object and space. Stepančič's levitational construction for the *Trieste Constructivist Ambient* (1927) [3] had a profound influence on Živadinov's conception of the complex and long-term work in progress, the 50-year theater performance *Noordung::1995–2045*. This is a postgravity art project, whose creators not only systematically develop new methodology and terminology [4] but also constantly discuss their "historical supports" in various forms, such as performances, *informances* and farewell rites. In addition to the Constructivist concept of an artwork in real space and Malevich's Suprematist ideas on future space technologies, the geostationary station concept of the Slovene space pioneer Herman Potočnik Noordung is crucial to this project and hence it bears his name [5] (Fig. 1).

The project differs from existing space art and art in zero gravity with its vision of emancipating technology and its role in the culturalization of space (by means of *telelogy*) [6]. The goal is to replace the deceased actors with artistic satellites, *umbots* [7], which will in 2045 be placed in a geostationary orbit. Postgravity art is defined as all art that is to be created in zero gravity and that will create yet-unknown systems, which will not be directly connected to the Earth anymore [8]. Roger F. Malina's space art typology [9], suggested in the late 1980s, does not include a type corresponding to the vision of postgravity art, while a feature of the project to include new philosophical concepts related to space exploration and the potentiality of new life forms in its expression is very important for our discussion.

ART HISTORICAL CONTEXTUALIZATION: THE RISE OF THE CONSTRUCTIVIST PRINCIPLE ON THE RELATION OF ABSTRACTION—ZERO-GRAVITY

Within the abstract art movement and its reflective use of geometric forms, two key directions formed in Russia in the second decade of the 1900s: the metaphysical, in the form of Suprematism, and the physical in the form of the avant-garde Constructivist movement, which linked art with its useful function, social and political activism. Kazimir Malevich's Suprematism is directed to the experience of pure nonobjectivity and with its strict reductionist procedure guided artistic form-making to seek out the ultimate formal elements, presented in their most economic and elementary form. This systematic reduction leads to the "zero of form" in painting and to new perspective that has no horizon [10]. This development led to a new concept of space in art, where space became a continuum expanding beyond a canvas [11]. The artist in his striving to surpass the limits of pictorial space achieves a nullification of illusionism while targeting the n-dimensionality and infinity beyond the 3D illusion. This opens a dynamic space which with the movement including

Mojca Puncer (philosopher, educator, art critic, curator), Poklukarjeva 23, 1000 Ljubljana, Slovenia. Email: <mojca.puncer@gmail.com>.

See <mitpressjournals.org/toc/leon/51/5> for supplemental files associated with this issue.

 doi:10.1162/LEON_a_01383

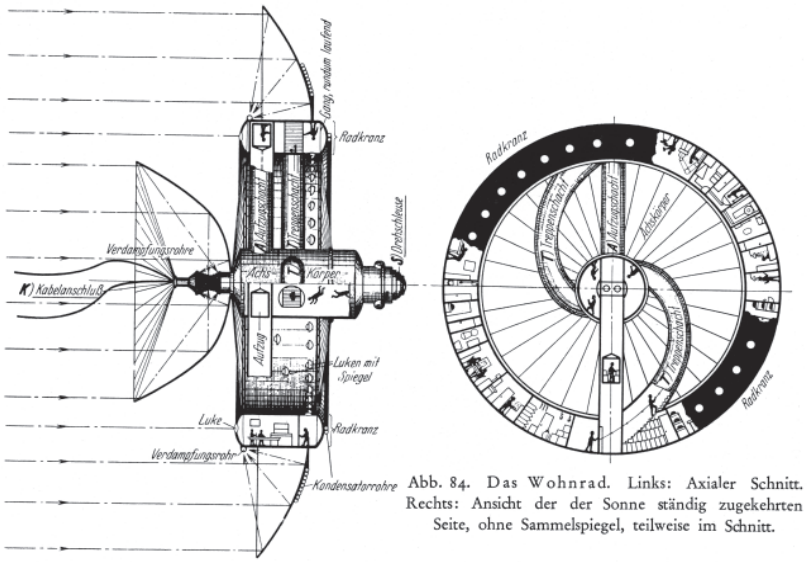


Abb. 84. Das Wohnrad. Links: Axialer Schnitt. Rechts: Ansicht der der Sonne ständig zugekehrten Seite, ohne Sammelspiegel, teilweise im Schnitt.

Fig. 1. Herman Potočnik Noordung, depiction of a space station from his book (technical drawing of the habitat wheel) *The Problem of Space Travel* (1929). Description: Treppenschacht=stairway. Aufzug=elevator. Aufzugschacht=elevator shaft. Achskörper=axle. (© KSEVT, licensed under a CC-BY NC ND 3.0 license.)

the element of time, the fourth dimension (understood also as a metaphysical, spiritual quality) [12]. Under the influence of the modern relativist (Einsteinian) concept of space-time, the experience of emptiness becomes a synonym for the liberation from the laws of Euclidian geometry. The fluidity of this new sense of space found its way into non-Euclidian geometry and toward a space of zero gravity. This is also a starting point for the central avant-garde utopian idea of the creation of a truly abstract art that can be enacted only in zero gravity (Dragan Živadinov's abstract theater). Malevich's Suprematism—especially his ideas of *architektons* (a series of 3D models, architectural forms made after 1920) and *planit* drawings (planet + satellite = new Suprematist satellite [13]) as Suprematist visions of space technology development—is one of the key historical supports of postgravity art. In his brochure "Suprematism, 34 Drawings," published in 1920, he posits the possibility of "interplanetary flight, and of orbital satellites (*sputniks*) that will allow man to appropriate cosmic space for himself" [14].

The shift into a cosmic space reconstructs avant-garde methodologies on the relation of abstraction—zero gravity [15]. The artists have tried to include perspective and Euclidian space relativization together with equating space and the cosmos in their spatial constructions. The category of space has thus become a central topic in the efforts to overcome gravity. In 1919, Malevich (although in connection with Suprematism) wrote that by discovering abstract painting, painters invented new elements representing problems of new architecture [16]. Constructivists have gone beyond painting toward architecture by traversing from the imaginary spaces of Suprematism to creating in real space. They transform spatial construction-exhibits into architectural ambiences assuming an active spectator.

Construction is a "system" relating to a 3D construction with technical drawing and to the work of engineers and scientists [17]. One of the main characteristics of an artistic construction as a system is its ability to be disassembled and reassembled again [18]. The power of the term "construction" derives from its numerous associations and connections: with the language, rationalization, advancements in the tools of science, technology and industry, and the construction of a new social reality. The language of constructivism has had a huge appeal for a wide range of artists working in otherwise radically different social and political contexts.

Avgust Černigoj is perceived as a pioneer of fine art Constructivism in Slovenia. Černigoj was inspired by the Russian tradition and Bauhaus and was a founder of the Trieste Constructivist Group (1926–1929), where his student Eduard Stepančič really stood out. During his formative years as a young artist, Stepančič took the Constructivist principle as a template in his creative work, which—together with his teacher—includes him within the international historical avant-garde context. As a young avant-garde painter, Stepančič and his colleagues tried to create something new with the means of geometric abstraction: "Art + object + function, this is a total synthesis of movement in space" [19]. With his segment of levitational construction (hung on transparent strings), Stepančič significantly contributed to the *Trieste Constructivist Ambient* (1927), which is perceived as a pinnacle of Slovene Constructivism and its final developmental stage (Fig. 2). "In addition to the mobiles, a white square also floated beneath the ceiling hung by strings; through this, for the first time in history Malevich's work stepped out of the context of a painting hung on the wall" [20]. The group of four artists built into the ambient a competitive stylistic formation, Suprematism. This unique synthesis of the polar ideas of Suprematism and Constructivism is—besides Stepančič's levitational construction as a forecast about overcoming gravity—a key reference for postgravity art projects. Its creators are inspired also by Stepančič's high-quality Constructivist drawings and other works, which are the result of his study of abstract art's possibilities. In the late 1970s and early 1980s, Stepančič started to use computer graphics [21]. In his mature creative phase, Stepančič was clearly aware that the use of a computer with programmed art procedures enables artists to efficiently dynamize abstract art.

The artistic use of new computer technologies brings a radical shift of focus from objects to mental processes and protocols, which has a significant impact on an experience of (visual) art and its spatial coordinates. For numerous artists, a computer is not just a passive tool for generating images but an important factor in expanding the possibilities of communication at the intersections of art, science and technology.

TECHNOLOGICALLY ADVANCED CONSTRUCTIVISM: THEORETICAL AND PHILOSOPHICAL IMPLICATIONS OF THE POSTGRAVITY ART PROJECT

The roots of electronic and computer-generated art go back to an early cybernetic art movement which developed in the 1960s as a consequence of a cybernetic movement in science during the 1950s [22]. Mathematical programming played an important role in this development, because it paved the road to the age of electronics, together with the ICT development. Within cybernetics as a systems and communication science, a field of cognitive science was formed in order to study the human psyche or consciousness in an interdisciplinary manner. Mathematicians and logicians' achievements (von Neumann, Turing) stimulated comparisons between computers and the human brain and encouraged the development of cognitive modeling, which serves as a foundation for the artificial intelligence (AI) project in the work of Minsky and Moravec [23]. The AI field includes technologies that enable computers to simulate certain mind processes, especially that of remembering and logical deduction, as is the case with the now-vast spread of smart technology.

In the early 1990s, the art and technology historian Frank Popper announced that AI's entrance into art represented a paradigmatic shift in response to universal digitization [24].

Fig. 2. *Trieste Constructivist Ambient* (1927), reconstruction for the exhibition *20th Century: Continuities and Ruptures*, Museum of Modern Art, Ljubljana, 2011. (© Zavod Delak)

New media theorist Lev Manovich summarized that computers have been used since the 1960s as production tools, but in the 1990s the computer became a "universal media machine" or "metamedium" [25]. Computers fundamentally change the nature of a work of art. According to Manovich, all new media objects are numerical representations, and numerous of their operations are automatized. When these processes achieve a certain semantic level, they can be discussed in the light of a broader AI project. Intelligent devices use different approaches to human intelligence simulation—from systems based on rules to systems based on neural network patterns. The theory of the quantum neural network served as a certain inspiration to the postgravity art project's creators as well [26].

Space is a zero-gravity environment that demands advanced technologies in order to articulate the cultural dimension (the project of space culturalization should complement the dominant scientific and commercial aspects of space exploration) [27]. The artistic treatment of abstract forms and abstracted information in this context represents a support for expanding an imaginary dimension of human intelligence into space. Space is also an especially suitable environment for artificial life, as it does not provide natural conditions for terrestrial forms of life.

Concurrent with the development of cybernetics and advanced research into AI, we have also seen the development of the idea of simulating not only mental processes, but life itself. Artificial life [28] deals with the study of (open, dynamic, complex) living systems (bearing in mind the discoveries about *autopoiesis* by Maturana and Varela) [29] and the possibilities of simulating them with computer-supported models. One of the fundamental AL assumptions is that life is only a quality of the organization of matter. We now witness an increasing convergence between AI and AL in the scientific and research fields (*nouvelle* AI, evolutionary robotics) [30]. Art's exploration of cybernetics also spans the homeostatic systems studies, *autopoiesis* and radical constructivism [31] and the birth and rise of AI and AL.

The project discussed here is a unique attempt to apply insights of cognitive science and AI (connectionist AI) as well as AL (theoretical biology, evolutionary theory) and build computer programs (*syntapiens*) [32] for achieving some sort of mind (analogues to biologically based minds). This is in accordance with its method of progressive substitution and understanding of AI as the next stage in evolution: "If one assumes that intelligence is grounded in life, then AI is somehow continuous with A-Life" [33]. Further issues concern "strong AI"/"weak AI" hypotheses (machines are actually thinking / machines could possibly act intelligently) as well as "strong AL"/"weak AL" hypotheses (life process can be abstracted away from any particular medium/if key biological properties are missing, living process can only be simulated) [34]. At the current stage of the project we can consider the potentials of emancipated technology only in connection with weak AI/AL hypotheses.

It is also important to question the role of the earthbound observer of the postgravity art system. Digital data processing

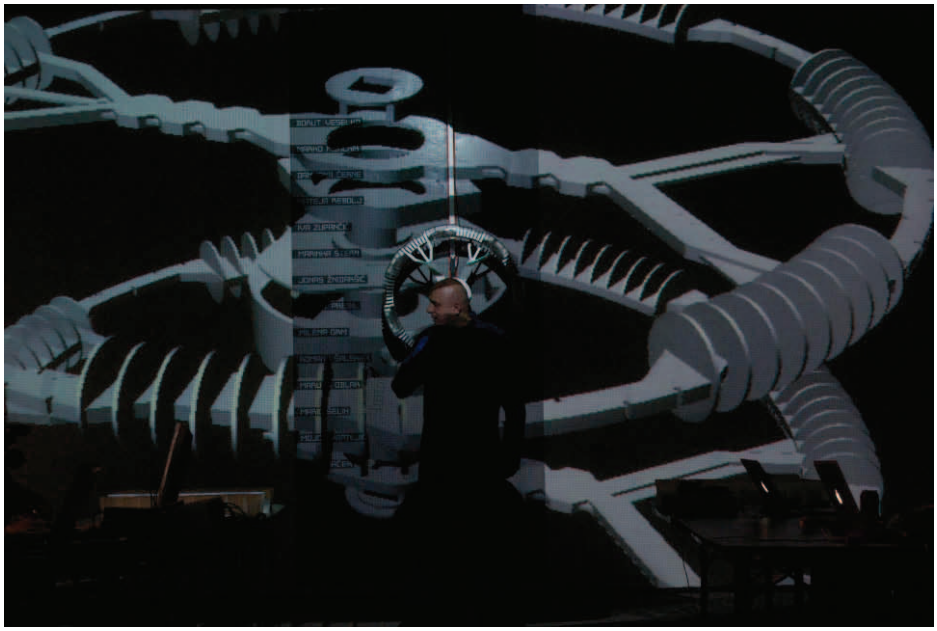


Fig. 3. Dragan Živadinov, Dunja Zupančič, Miha Turšič, *Postgravityart::Syntapiens*, Eyebeam NY, 2009. (© Zavod Delak)

and modeling cybernetic, adaptive (viable), lifelike and "intelligent" structures, complex environments and networks as a rule directly include a spectator in the act of co-creating and transforming a work of art using an interactive principle (an informational feedback loop). At the current stage of the postgravity art project, this aspect is not yet explicit, but its vision anticipates an access to the database (artistic satellites—*umbots*) (Fig. 3). Access will be possible through a technological interface, and the "user" together with a high-tech artifact will constitute a hybrid cybernetic system. Artistic satellites can be understood as specific databases (with information about the deceased actors). In this respect we posit a new media object, previously defined by Manovich. According to him, the creation of a new media work of art can be understood as the construction of an interface to a database [35]. In our case, this base would be a technological form of life under zero-gravity conditions and an intelligent artificial being or system at the same time, and it should acquire awareness and intelligence, which have the potential to develop into something new, different from human consciousness.

Within this context, I study art deriving from the cybernetic paradigm as a special field of AI and emerging technoscience (such as synthetic biology), characterized by the ideology of transhumanism. It represents a major challenge for both interdisciplinary spheres of technology assessment and the humanities [36]. The related 1990s concept of posthumanism stresses the need to critically reevaluate the boundaries of the humanness and structure of Western humanism. In contrast to transhumanism, which reduces human beings to minds and information patterns [37], posthumanism emphasizes an unstable relationship between embodied subjectivity and technoscience [38]. The case project opens a philosophically motivated transhumanist discussion (with impulses from Russian cosmism [39]) regarding the possibility of preserving life through technoscientific intervention. Thus the project, with its futuristic-utopian attitude rooted in transhumanism and its Constructivist approach, raises a number of issues that are critically addressed in the context of posthumanism, such as deconstruction of binary oppositions: subject/object, body/mind, form/content, content/technological interface, art/science, etc.

One of the typical and relevent features of Constructivism is its defense of a new unity among art, science and technology. What we are interested in here are also the new possibilities of thinking offered by the integration of cognitive constructivism and systemic theoretical concepts. We are talking here about an epistemological and evolutionary transdisciplinary model originating in a cybernetic paradigm and in a metasystem [40], exceeding unproductive disciplinary divisions and achieving synthesis on a higher level.

Contemporary artistic endeavors, especially those striving to integrate science and technology, are increasingly connected with (navigable) databases as complex systems. From this point, it is only a step toward systematic and technologically advanced Constructivism, which constitutes the postgravity art project of Živadinov, Zupančič and Turšič.

CONCLUSION

With the establishment of the retro-avant-garde movement Neue Slowenische Kunst (NSK) in the 1980s in Slovenia, Dragan Živadinov, within the theater area [41] of his artistic studies, revived some of the fundamental principles of the historical avant-garde tradition [42]. In his endeavors to realize a work of art under zero-gravity conditions, the artist refers to the avant-garde idea of overcoming gravitational forces. Beside the work of visionary rocket scientist H.P. Noordung, the key work of art heralding postgravity art is the aforementioned levitating construction by Eduard Stepančič (one of the first in the world). This recently unknown art-

Fig. 4. Dragan Živadinov, Dunja Zupančič, Miha Turšič, *Postgravityart::SYSTEMATICS*, informance, City Art Gallery, Ljubljana, 2014. (© Zavod Delak)

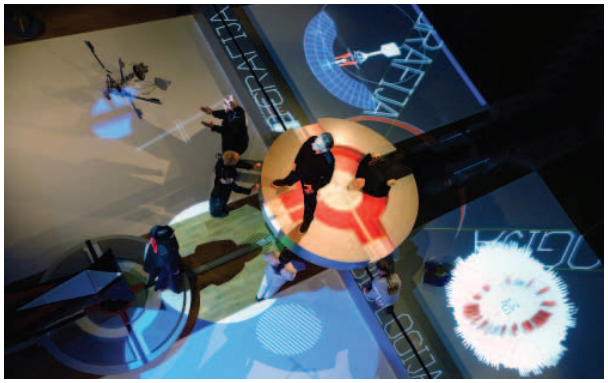


Fig. 5. Dragan Živadinov, Dunja Zupančič, Miha Turšič, *Noordung::1995–2015–2045*, biomechatronic projectile, second reprise, 20 April 2015, KSEVT, Vitanje. (© Zavod Delak)

ist has become such an important reference point for the three makers of postgravity art because their contemporary execution of his discoveries is shown also in the form of a unique, technologically advanced systemic constructivism, constantly problematizing gravitation. *Noordung::1995–2045* is based on the idea of five replays every ten years with the same actors (14) until 2045, where the bodies of the deceased actors will be replaced by remotely controlled signs, which shall appear in the final phase of the "performance" as "cognitive synthetic constructions" [43] placed into the Earth's orbit. Theatrical abstractions will thus become artistic satellites transmitting biological, biographical and visual information about their former human carriers (ICT, telematics) to Earth and into deep space. The current phase in the biological bodies substitution process deals with "genetic construction" and the relation between biology, artistic biography and IT (Fig. 4), which is even more topical just before the second replay (it was held 20 April 2015) (Fig. 5). Before the second replay, a process to replace the first deceased actress's body by technological substitution was already set in motion (Color Plate B).

Postgravity art is heterotopic [44] in its search for an optimal projection of future developments; it is conceptual and processual, developmental artistic practices of creating a space, where art under zero-gravity conditions should be possible in the near future. In new living conditions, it will form new, yet unknown systems. The new system in the field of arts thus includes postgravitational artistic constructions on the skies of emancipated technology and transhumanism. Events such as exhibition informances (Fig. 6) are places of reflection regarding the "framework" within which postgravity art strives to expand the perception of space for an artistic event and so reveals its formal, theoretical and philosophical, and ideological implications.

Fig. 6. Eduard Stepančič//Zupančič::Turšič::Živadinov, *Programmed Visualisation//Postgravityart::SYSTEMATICS*, exhibition informance, ZKŠT—Savinov likovni salon, Žalec, 2014/2015 (Left: suprarchitecton; Right: DNA holders in test tubes, UV-digprint on Dibond plates). (© ZKŠT Žalec. Photo © Gašper Domjan.)

Glossary

autopoiesis—a system's ability to reproduce and maintain itself (Maturana and Varela).

constructivism—an art movement, founded in Russia around 1915, committed to the idea of art as a practice for social purposes; by 1920, Russian artists who followed this idea were calling themselves constructivists.

heterotopia—actually existing places, "counter arrangements" in society, "sacred or forbidden places" (according to Foucault): psychiatric clinics, prisons, cemeteries and institutions such as theater, museums or libraries; in the context of postgravity art, the department of a space agency.

informance—a form of informing the public about the current position of the project *Noordung::1995–2045*; it involves the appearance of the actor's body onstage as information: the informer tends to become a technological abstract.

Neue Slowenishe Kunst (NSK)—Slovenian art collective founded in 1984 by three groups—Laibach (music), IRWIN (visual art) and Scipion Nasice Sisters Theater (performing arts).

postgravity art—all art that is to be created in zero gravity and that will create yet-unknown systems, which will not be directly connected to the Earth anymore.

posthumanism—critical theory, inspired by poststructuralism, feminism and deconstruction in questioning the concepts of classical humanism; it strives for ethical reflections on the human condition in relation to emerging technoscience and its key figures, such as robots and cyborgs.

suprematism—an abstract art movement in Russia, announced by Kazimir Malevich in 1915, focusing on basic geometric forms in constellations suggesting overcoming gravity.

syntapiens—digital "suprabstract" of an actor's face made up of three carrier programs: micronic depiction of the actor's face, collection of actor's mimes and genetic texture of the actor.

telelogy—digital strategy of postgravity art, which builds on the potentials of telematics.

transhumanism—intellectual and sociocultural movement, which defends the use of science and technology for improving human capabilities and transgressing their limits.

umbot—*um* (Slovenian: mind, also short for art) + robot = *umbot*.

References and Notes

1 Eduard Stepančič (Trieste, 1908–Belgrade, 1991) studied fine art in Monza, Venice and Florence. Between 1926 and 1929 he was a member of the Trieste Constructivist Group, led by the renowned avant-garde artist Avgust Černigoj (1898–1985). Aside from Černigoj, he is considered the most prominent representative of Slovenian Constructivism. See Nina Pirnat-Spahič and Peter Krečič, eds., *Eduard Stepančič and the Principle of Constructivism* (Ljubljana: Cankarjev dom, 2006).

2 Dragan Živadinov was also a cofounder of the art movement NSK in 1984. In 1998 he became a candidate cosmonaut at Russia's Yuri Gagarin Cosmonauts Training Center and in 1999 realized *Biomechanics Noordung*, the first complete theater production in zero-gravity conditions (Supplemental Fig. 1). In 2005, he staged the first reprise of *Noordung::1995–2005–2045* (Supplemental Fig. 2).

3 *Trieste Constructivist Ambient* (or *Cabinet*) was made by four artists, Avgust Černigoj, Eduard Stepančič, Giorgio Carmelich and Josip Vlah; with this collective artwork they have appeared at the exhibition of the Union of Fine Artists in the Pavilion of the Giardio Pubblico M. Tomasini 1927 in Trieste. After the only black-and-white photograph of its original installation (published in the avant-garde magazine *Tank* in 1927 in Ljubljana) a reconstruction was made in 2011 for the exhibition *20th Century: Continuities and Ruptures* in the Museum of Modern Art Ljubljana, Slovenia (Fig. 2).

4 Dragan Živadinov et al., "50 Coordinates of Postgravity Art," <postgravityart.eu/50/index_50.html>) (accessed 13 June 2018). See also <www.scribd.com/document/31097592/50-kordinat#scribd> (accessed 8 March 2015): coordinates are numbered (unlike on the artists' website), but only the main terms are translated into English.

5 Slovenian space pioneer Herman Potočnik Noordung (1892–1929), in the book *The Problem of Space Travel: The Rocket Motor* (1928; 2nd Engl. ed., Ljubljana: KSEVT, 2010), outlined solutions for problems with regard to conquering outer space; he is also known as a founder of space architecture (design of architectural forms that would allow the life of humans under conditions of weightlessness). See <www.dlib.si/details/URN:NBN:SI:DOC-QK9YCo9U> (accessed 3 August 2015).

6 See Živadinov et al. [4] (coordinate 45).

7 Živadinov et al. [4] (coordinates 4, 13).

8 Živadinov et al. [4] (coordinates 1, 2).

9 Roger F. Malina, "In Defense of Space Art: The Role of the Artist in Space Exploration," listing five types of space art <www.diatrope.com/rfm/docs/Malina_Space_1991.pdf> (accessed 20 December 2014). Arthur Woods in his "Brief History of Space Art Definition" refers to R. Malina and lists seven types <www.arsastronautica.com/article.php?news_id=6> (accessed 20 December 2014); likewise does Stephen Wilson in his book *Information Arts: Intersection of Art, Science, and Technology* (Cambridge, MA, and London: MIT Press, 2002) p. 263. I use the term *postgravity art* as another subcategory in addition to *zero gravity art*, under the auspices of the general term *space art*. The term was introduced by the artists themselves and taken into account by various theorists (including myself). The prefix "post-" indicates the overcoming of gravity as well as the potential of emancipated technology "after" the unique 50-year theatrical process.

10 Kazimir Malevich, "From Cubism and Futurism to Suprematism: The New Realism in Painting" (1915), <www.mariabuszek.com/mariabuszek/kcai/ConstrBau/Readings/MlevchSupr.pdf> (3 August 2015) p. 1. For Malevich, the square was "the first step of pure creation in art" (p. 8). Cf. also John Milner, *Kazimir Malevich and the Art of Geometry* (New Haven, CT, and London: Yale Univ. Press, 1996) p. 125.

11 Cf. George Rickey, *Constructivism: Origins and Evolution* (New York: George Braziller, 1995) pp. 105–107.

12 Regarding the perception of the fourth dimension, Malevich referred to the philosophy of Peter Demianovich Ouspensky and other Russian mystical theorists: see Anna Moszynska, *Abstract Art* (London: Thames and Hudson, 1990) pp. 56–58.

13 See <www.scribd.com/document/31097592/50-kordinat>, coordinate 26 (planits).

14 Quoted in Gilles Néret, *Kazimir Malevich 1878–1935 and Suprematism* (Köln: Taschen, 2003) p. 65.

15 Malevich's abstraction in the line with abolition of the horizon,

connection of zero gravity with the fourth dimension, etc., has already occupied the studies of renowned interpreters such as L.D. Henderson, J. Milner, A. Moszynska, P. Railing and L. Zhadova.

16 Moreover, for the implementation of the transition from Suprematism to Constructivism, which were set up as two competitive positions, El Lissitzky is especially notable; this passage illuminates Janez Vrečko in the article "Tatlin, El Lisicki in Kosovel," *Primerjalna književnost* **32**, No. 1, 78 (2009).

17 Among the first constructivists to connect art with science and new technologies was the Hungarian-born artist László Moholy-Nagy (1895–1946), a teacher at the Bauhaus (in 1924 he taught future leading Slovenian constructivist Avgust Černigoj).

18 Briony Fer, "The Language of Construction," in B. Fer, D. Batchelor and P. Wood, *Realism, Rationalism, Surrealism: Art between the Wars* (New Haven; London: Yale Univ. Press, 1993) pp. 108–109.

19 Avgust Černigoj, Manifesto "Group of Constructivists from Trieste" (1927), in B. Ilich Klančnik and I. Zabel, eds., *TANK! slovenska zgodovinska avantgarda* (Ljubljana: Moderna galerija, 1998) p. 54.

20 Janez Vrečko, "Formiranje Kosovelovega konstruktivizma—spopad med kompozicijo in konstrukcijo," *Primerjalna književnost* **33**, No. 1 (2010) p. 22.

21 There is a valid presumption that Eduard Stepančič, while in Trieste, became acquainted with the work of one of the world's pioneers in computer art, Edward Zajec. See Krečič in Pirnat-Spahič and Krečič [1] p. 37.

22 American mathematician Norbert Wiener introduced the term *cybernetics* in his 1948 book *Cybernetics: Or Control and Communication in the Animal and the Machine* (see also 2nd ed., New York; London: MIT Press; J. Wiley & Sons, 1961).

23 The challenging proposal for the transfer of the human mind into a virtual computer domain ("uploading") comes from Hans Moravec—see H. Moravec, *Mind Children: The Future of Robot and Human Intelligence* (1988) (Cambridge, MA, and London: Harvard Univ. Press, 1995, 4th ed.).

24 Frank Popper, *Art of the Electronic Age* (London: Thames and Hudson, 1993) p. 177.

25 Lev Manovich, *The Language of New Media* (Cambridge; London: MIT Press, 2001) pp. 4, 6.

26 The authors of the postgravity art project refer to Slovenian neuroscientist Mitja Peruš, the first in the world to begin exploration of quantum associative neural networks (see e.g. M. Peruš: "Neural Networks as a Basis for Quantum Associative Networks," in *Neural Network World* **10**, No. 6, 1001–1013 [2000]). See [4] (coordinate 23).

27 This is also the mission of the Cultural Centre of European Space Technologies (KSEVT), Vitanje, Slovenia: <www.ksevt.eu> (accessed 20 December 2014). See also https://www.culture.si/en/Cultural_Centre_of_European_Space_Technologies_(KSEVT) (accessed 15 June 2018).

28 Christopher G. Langton in his renowned article "Artificial Life" (see in Margaret A. Boden, ed., *The Philosophy of Artificial Life* [Oxford: Oxford Univ. Press, 1996] p. 40) sets out the field of AL as a synthetic approach to biology that leads beyond known biological phenomena: "beyond *life-as-we-know-it* into the realm of *life-as-it-could-be*."

29 Maturana and Varela are among those heralding the so-called new cybernetics (exploration of complex living systems): see H.R. Maturana and F.J. Varela, *Autopoiesis and Cognition: The Realization of the Living* (Dordrecht, the Netherlands; Boston; London: D. Reidel, 1980). See also P. Bourgine and F. Varela, "Introduction," in F.J. Varela and P. Bourgine, eds., *Toward a Practice of Autonomous Systems: Proceedings of the First European Conference of Artificial Life* (Cambridge; London: MIT Press, 1992) pp. xi–xvii. What is essential for an *autopoietic* system is that it produces its own structure, components and limits where it uses communication for its specific manner of reproduction (viability).

30 See e.g. Benjamin Inden and Jürgen Jost, "Neural Agents Can Evolve to Reproduce Sequences of Arbitrary Length," in P. Liò et al., eds., *Advances in Artificial Life*, ECAL 2013 (The Twelfth European Conference on Artificial Life, Part I), <www.mitpressjournals.org/doi/abs/10.1162/ecal_a_0001_10a> pp. 184–191 (accessed 30 October 2014).

31 We are dealing here with the position of so-called radical constructivism, grounded in the book by Ernst von Glasersfeld, *Radical Constructivism: A Way of Knowing and Learning* (1995) (London; Washington, D.C.: Falmer, 1997), which, in conjunction with the systemic theory (contribution of Maturana and Varela, etc.) provides a new epistemological model (an individual constructs his/her knowledge of the world from his/her own experience, with the construction of more or less viable conceptual structures) that can also be used in new media art theory.

32 See Živadinov et al. [4] (coordinate 3).

33 Margaret A. Boden, "Introduction," in Boden [28] p. 5.

34 See Boden [28] pp. 24–28.

35 Manovich [25] p. 226.

36 This aspect is highlighted in a recent article by Christopher Coenen, researcher at the Karlsruhe Institute of Technology in Germany—see C. Coenen, "Transhumanism in Emerging Technoscience as a Challenge for the Humanities and Technology Assessment," *Teorija in praksa* **51**, No. 5, 754–77 (2014).

37 A prominent advocate of transhumanism is the futurologist Ray Kurzweil, a director of engineering at Google, who popularized the core of the transhumanist vision of so-called "cybernetic immortality" (discussions on the uploading of human brains to computers, etc.); see *The Singularity Is Near: When Humans Transcend Biology* (London: Duckworth, 2006) pp. 198–203.

38 See N. Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago; London: The University of Chicago Press, 1999).

39 Russian cosmism is one of the main historical supports of postgravity art. Many ideas were further developed within transhumanism. See Živadinov et al. [4] (coordinate 11).

40 Heinz von Foerster, for example, introduces the concept of second-order cybernetics—see Heinz von Foerster, *Understanding Understanding: Essays on Cybernetics and Cognition* (New York [etc.]: Springer, 2003).

41 For the pre-history of *Noordung::1995–2045,* see <www.culture.si/en/Noordung_Cosmokinetic_Cabinet> (accessed 3 August 2015).

42 This is a sort of media archeology, practiced by artists and accompanied by theoretical efforts as "an emerging attitude and cluster of tactics in contemporary media theory that is characterized by a desire to uncover and circulate repressed or neglected media approaches and technologies"—Jussi Parikka in conversation with Garnet Hertz, "Archaeologies of Media Arts" <www.ctheory.net/articles.aspx?id=631> (accessed 3 August 2015).

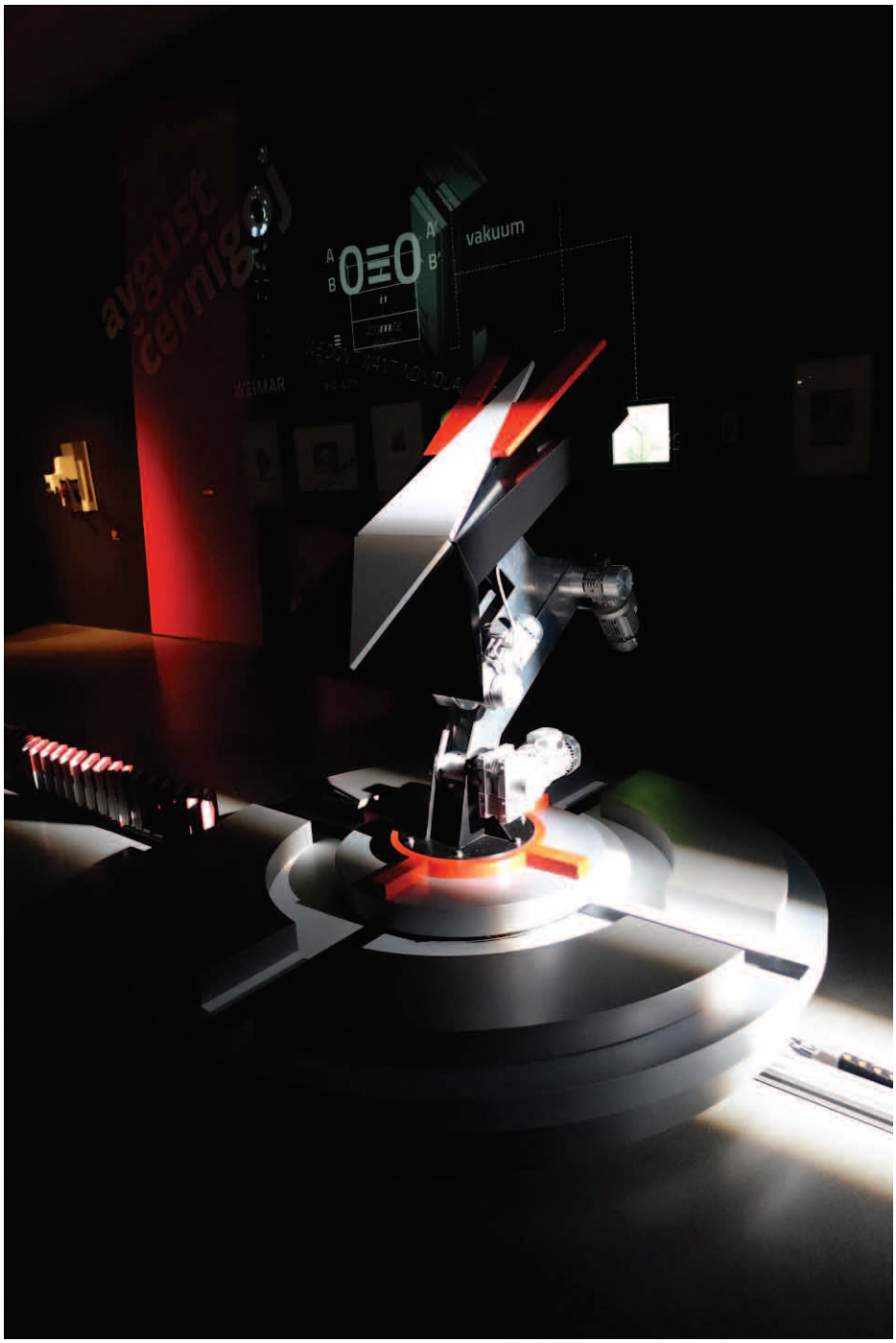
43 See Živadinov et al. [4] (coordinate 33).

44 See Michel Foucault, "Of Other Spaces: Utopias and Heterotopias," in Neil Leach, ed., *Rethinking Architecture: A Reader in Cultural Theory* (New York City: Routledge, 1997) pp. 330–336.

Manuscript received 11 February 2015.

MOJCA PUNCER *is an assistant professor of philosophy at the University of Maribor, Slovenia. She works as a university lecturer and researcher, as an independent theoretician, critic and curator in the field of contemporary art, as a cultural educator and as a publicist.*

COLOR PLATE B: **ADVANCED CONSTRUCTIVISM AND POSTGRAVITY ART: THEORETICAL AND PHILOSOPHICAL IMPLICATIONS**



Dragan Živadinov, Dunja Zupančič, Miha Turšič, *Biomehatron::MG*, MSU, Zagreb, 2015. (© Zavod Delak) "Biotransmitter," antenna, which in 2045 will connect our gravitational reality with an artistic satellite, "MG" (a technological substitute for the first deceased actress, Milena Grm) installed on an equatorial orbit. (See article in this issue by Mojca Puncer.)