

LITHUANIAN SPACE AGENCY



ANNUAL
REPORT
NO. 1

4 Julijonas Urbonas
1st Report: Introduction

16 Isora x Lozuraityte
Studio for Architecture
Adaptable Structures
& Poetics of Matter

① GRAVITATIONAL AESTHETICS

36 Julijonas Urbonas
42 Standing
56 Falling
Levitating

② PLANET OF PEOPLE

84 Julijonas Urbonas
and Studio Pointer*
Speculative Dialogue

96 Regine Debatty
Interview with
Julijonas Urbonas

3

FEASIBILITY STUDIES

111	Lauren Reid
117	Li Geng
119	Michael Clormann
123	Xin Liu
125	Rebekka Ladewig
135	Hu Fei and Jia Liu
139	Theodore W. Hall
145	Lisa Messeri
147	Michael P. Oman-Reagan
151	He Renke
153	Ma Yansong
157	Joseph Popper
165	Fred Scharmen
169	Vidas Dobrovolskas
171	Craig Jones
175	Zheng Yongchun

178	Team
184	Acknowledgements
190	Colophon

POSTER

Selected Works by
Julijonas Urbonas

JULIJONAS
URBONAS

1ST REPORT:
INTRODUCTION

What happens to imagination once it leaves Earth? Crossing the Kármán line, the boundary between the earth's atmosphere and outer space, becomes disoriented. After all, imagination has evolved in the earth's ecosystem, held by gravity and human care. Catapulted up there, imagination is confronted with the hostility of outer space, otherworldliness at its most acute. How can we attune imagination to such a departure from our terrestrial origins?

Even though the arts, science, fiction and religion – to name a few – have often been reimagined from the perspective of the cosmos (with the prefix 'astro' marking such a departure from terrestrial thinking), most of these domains of thinking and making suffer from a certain degree of Earth sickness. For example, faced with humanity's survival, too often they simply

search for a shelter in the cosmos that is merely a replica of Earth based on current human conditions or our recent history. The ground is lifted up, turned upside down, suspended in midair, and yet the sensual, psychological and social planes are often, if not always, left Earth-bound. The majority of space programmes around the world manifest such a terrestrial conservatism, often underpinned by material and (astro) ecological exploitation, colonialism and warfare. The moment of history we live in has been recently labeled as the 'Second Space Age', characterised by the emergence of an outer space economy, the (private) commercialisation of space, an increase in space debris, interplanetary biocontamination and the establishment of the astroanthropocene.

I was concerned with such a crisis of cosmic imagination, so I established the Lithuanian Space Agency (LSA), an astro-disciplinary initiative that aims to create a truly extraterrestrial imagination. A think-tank-cum-space-logistics-company, the LSA has been researching and developing poetic logistics of establishing alternative ways of being and imagining together both on and beyond Earth. Acknowledging the cosmos as the site of radical otherworldliness, the agency focuses on how we can get closer to the un-earthly while also shifting perspectives on humanity to those of an alien. However, being aware of the near if not total impossibility of its mission and the cold indifference of the universe, the LSA believes that the only way to access the cosmic is through our capacity to imagine cosmically, employing techniques of pretence, make-

believe and simulation as vehicles to multiple cosmoses. This plural term lies at the core of the LSA's ethos: the cosmos is a multiverse with an infinite number of realities, including some that will never be accessible to us earthlings. As such, the LSA combines knowledge and tools from the multitude of scientific or artistic disciplines, but does not limit itself to disciplinary approaches and looks into ways to unlearn terrestrial thinking.

The conceptual background of the LSA is largely based on my decade-long artistic research into what I call gravitational aesthetics. Looking into gravity's impact upon us, our thinking and imagination, I have developed a set of gravity-defying creative tools to tap into unprecedented sensual, psychological and social domains. Embedding these tools into the combination of

such fields as design choreography, vehicular poetics, amusement park engineering, performative architecture, art and sci-fi, I have designed experiences that push the body and imagination to their extremes. The most recent materialisation of this practice is the project *Planet of People*, a scientific and artistic study of an artificial planet made of human bodies. One of the project's propositions is to catapult a group of human bodies into a specific location in outer space where they will be free of planetary gravity, light and air. Over a period of time, these irregularly dispersed levitating bodies would be drawn to each other due to their weak gravities and clump together, thereby forming a new celestial body. *Planet of People* is a quasireal, multimodal fiction based on scientific feasibility studies as well as on various narrative devices

combining digital animation, set design, interactive art, fiction writing, sci-fi music etc. The project has been transferred to the LSA to advance its complex intellectual grounding, which spans astroaesthetics, the eschatological imagination, the astroanthropocene, extraterrestrial anthropocentrism and terraforming.

This first report of the agency documents both its prehistory and its current activities that mostly revolve around the project, *Planet of People*.

Following this introductory text, **Isora x Lozuraityte Studio for Architecture** (the designers of the LSA laboratory) have transformed their working documents for the architectural concept of the LSA into a poetic and abstract graphic essay.

Then, in the first part of the report, I introduce gravitational aesthetics through its manifestation in three fundamental interactions with gravity: standing as resistance to gravity; falling as submission to it and levitating as escaping the force. In the short essay, 'Standing,' I discuss how gravity has become one of the defining factors in the evolution of the human species. 'Falling' is my take on the creative act of bending the trajectory of a fall as exemplified by a roller coaster, which I consider a unique genre of art. 'Levitating' is my experiential overview of the key technologies that simulate weightlessness. All these texts were written a while ago when I was conducting my PhD research at the Royal College of Art in London. These texts were included in the report to provide a glimpse into the context of gravitational

aesthetics. In addition to these texts, the publication includes an appendix: a poster-chart presenting eight selected projects of mine. These projects demonstrate the diverse manifestations of gravitational aesthetics. Some projects presented in the poster are realised at their intended scale, some take the form of a non-functioning prototype, some are a fiction, others a combination of all three. The projects are titled: *Barany Chair*, *Airtime*, *Cumspin*, *Oneiric Hotel*, *Cerebral Spinner*, *Euthanasia Coaster*, *Emetic Spatula*, *Hyper-gravitational Piano*.

Further in the report, one of the agency's contributors, **Réqine Debatty** has interviewed me in order to untangle the complex background of *Planet of People*. Along with **Debatty's** interview, I and **Studio Pointer*** present 'Speculative Dialogue', an examination of the psycho-

logical conditioning that would be necessary for the hypothetical participants of *Planet of People*. Here, we question why anyone would commit to a project that would irreversibly change their lives and what psychological obstacles they might have to overcome.

The final part of the report includes the feasibility studies for *Planet of People* submitted by the LSA's scientific community. These participants come from fields such as astrophysics, astroanthropology, astrobiology, space history, space arts, among others. The agency has asked them to analyse *Planet of People* and deliver the results in whichever form and length of writing best suited to convey their contemplation.

With their scientific expertise in different fields of space science, the contributions by

Vidas Dobrovolskas, Theodore W. Hall and Zheng Yongchun provide us with compelling evidence of the attainability or impossibility of *Planet of People*. Rebekka Ladewig's short essay is an overview of historically important scientific breakthroughs that determined the trajectory of space missions, colonisation of space and, as she calls it, the arrival of the age of anthropocentrism. The texts by Li Geng, Lisa Messeri, Michael P. Oman-Reagan, Lauren Reid and Fred Schärmen, address the complexity of the concept of the 'human'. Their texts, although very different in form, consider the human desire to transcend our bodies (and Earth) and, as Lauren Reid has put it, to see ourselves as 'disembodied consciousness, as God, as structural material', an element of the universe that is still hard to grasp. Xin Liu and He Renke go even further by proposing to

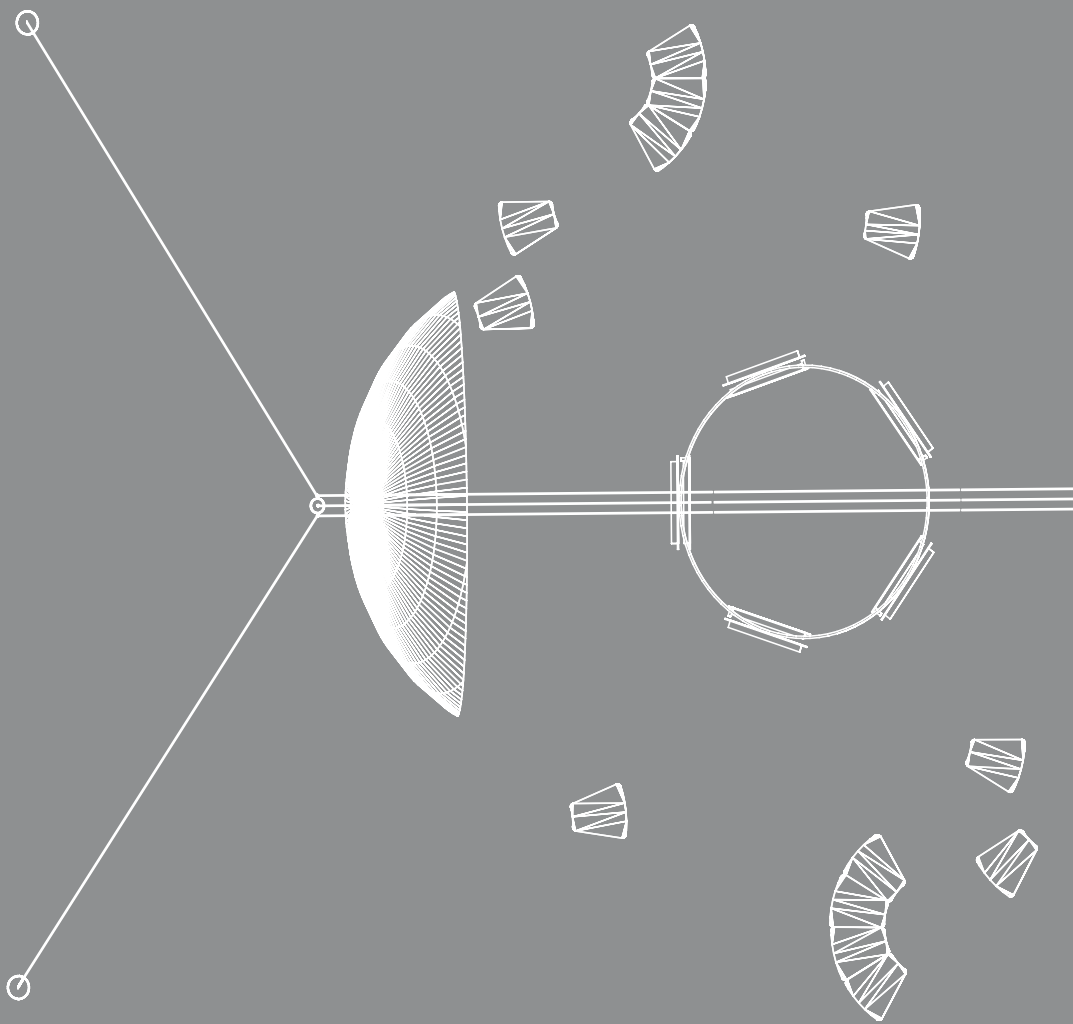
look at the possibility of opposing gravity or even extending our existence by means of technology. While there is a willingness to go beyond Earth and our Earth-bound bodies and minds, **Michael Clormann**, **Craig Jones** and **Ma Yansong** suggest there is also a need to look at current life on Earth and that *Planet of People* offers a conceptual lens to consider our condition here. The dialogue between **Hu Fei** and **Jia Liu** raises questions about the extreme anthropocentrism of *Planet of People*. **Joseph Popper** discusses desolation as a visual and rhetorical theme shaping popular imaginations of outer space.

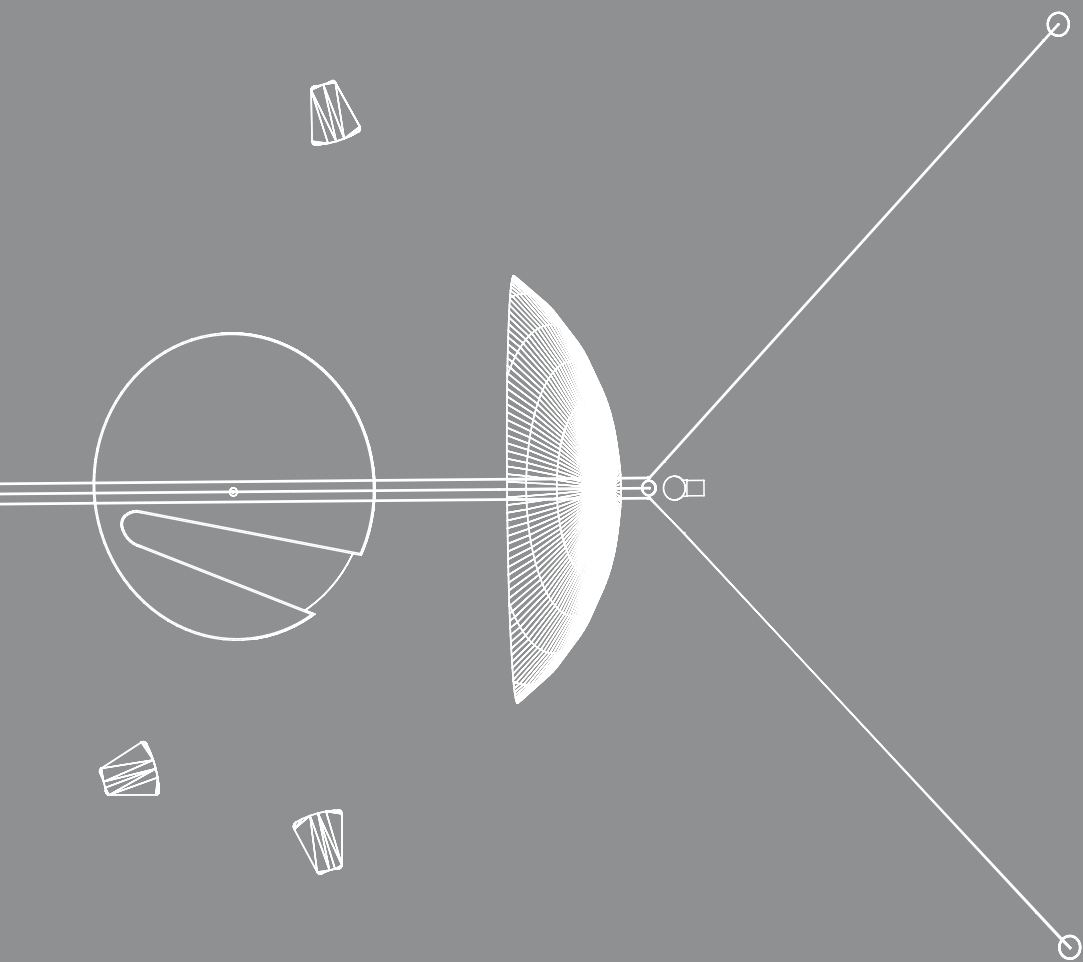
We are more than happy to announce that the project will represent Lithuania at the 17th International Architecture Exhibition, La Biennale di Venezia.

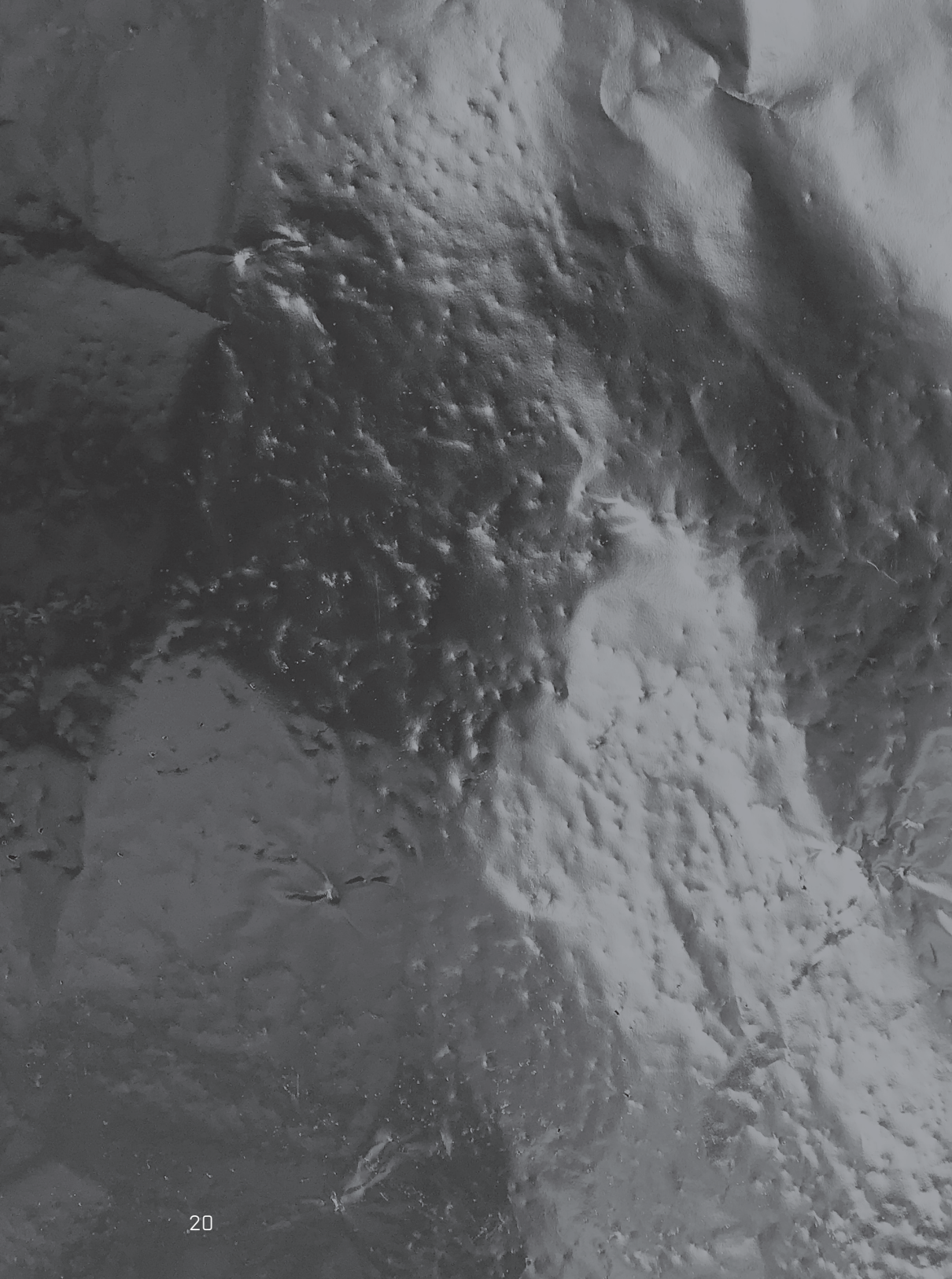
ISORA X
LOZURAITYTE
STUDIO FOR
ARCHITECTURE

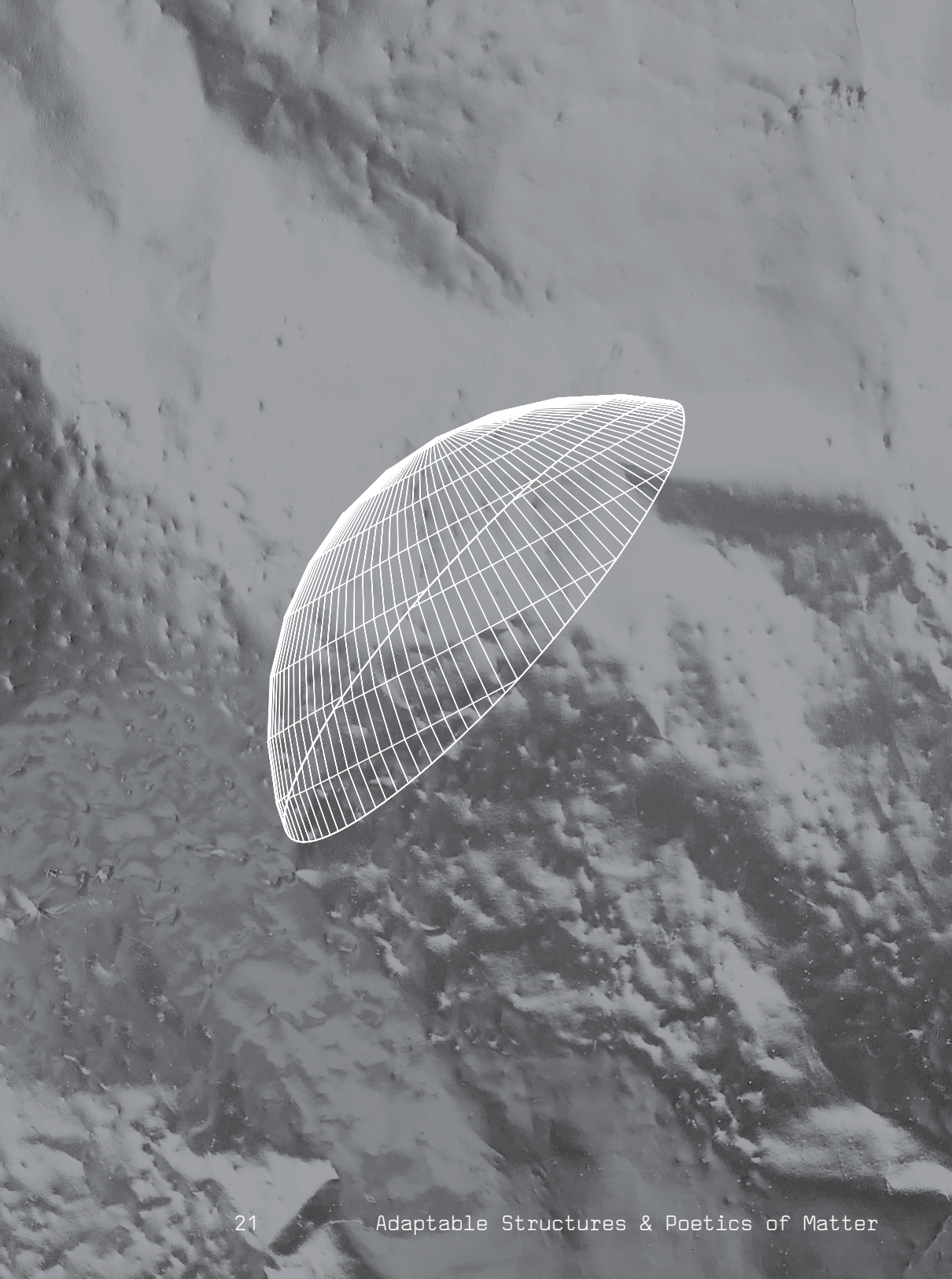
THE LSA:
ADAPTABLE
STRUCTURES
& POETICS OF
MATTER

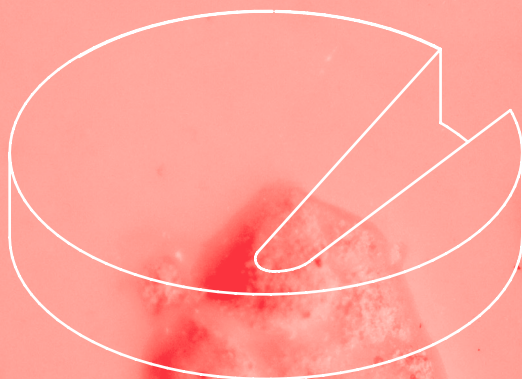




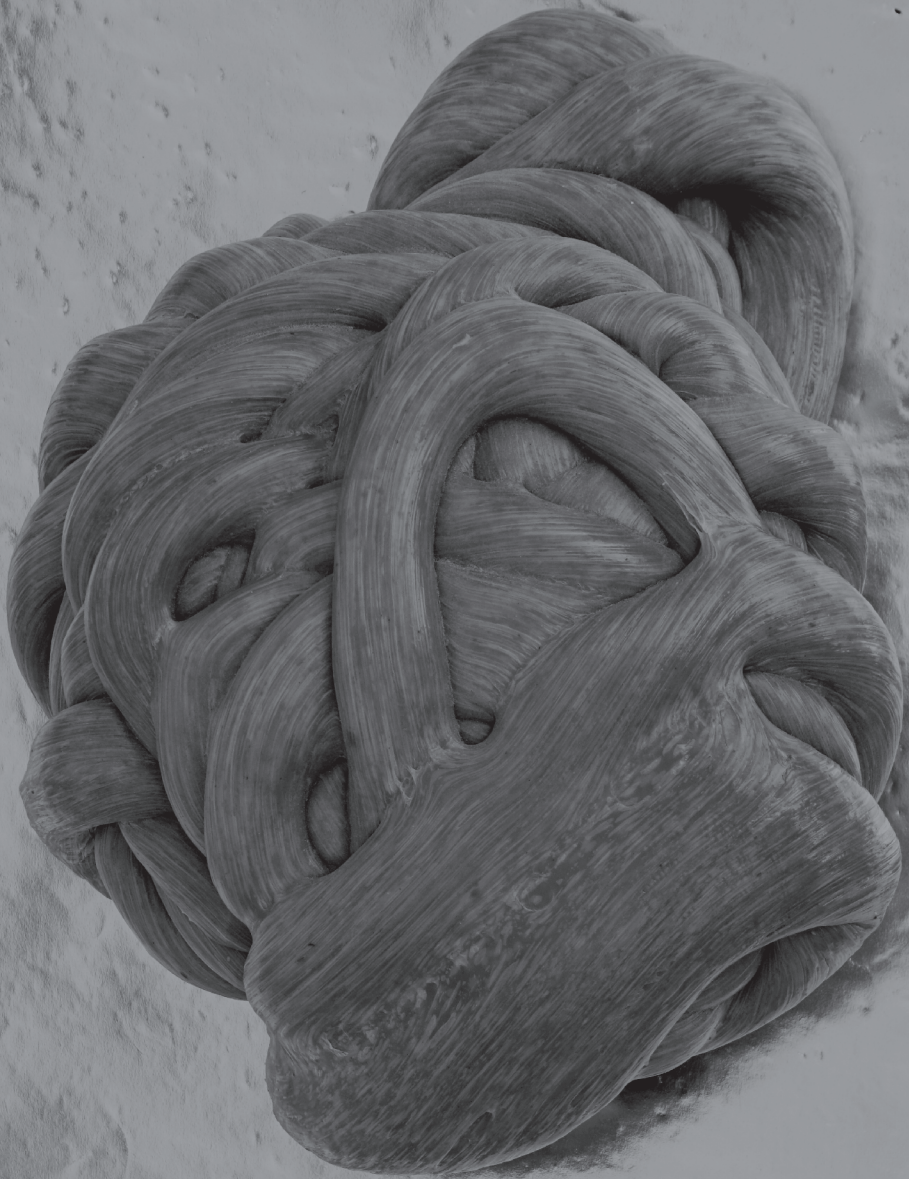


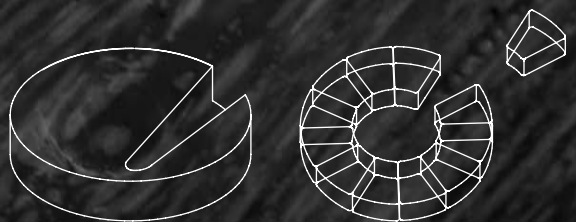




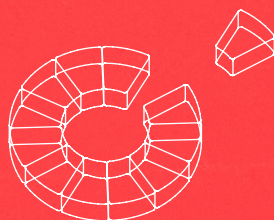










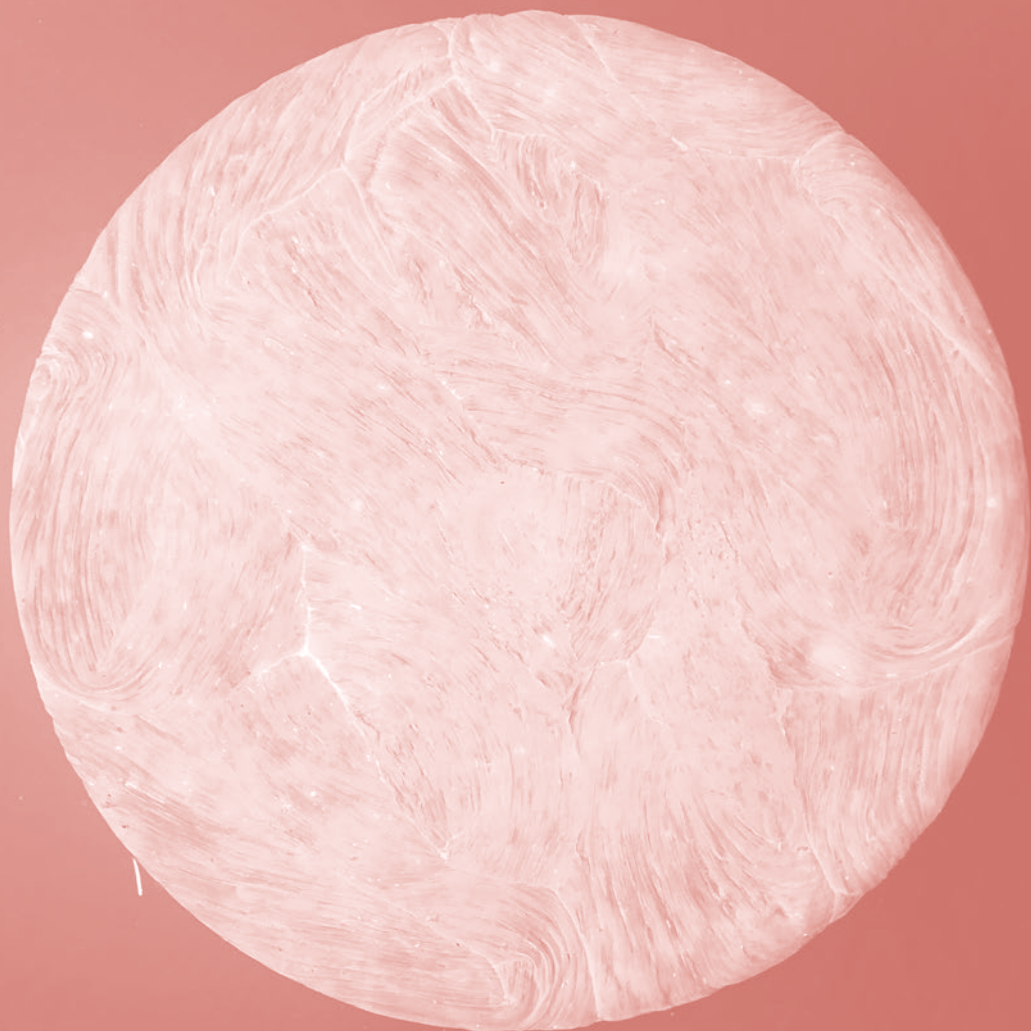












GRAVITATIONAL AESTHETICS

JULIJONAS
URBONAS



STANDING:
THE ORIGINS OF
HOW GRAVITY,
THE HUMAN AND
TECHNOLOGY
OVERLAPPED

The pre-human stood up and became a human. Erecting ourselves against gravity skywards we literally and symbolically moved away from the ground and acquired an unprecedented distinction: the upright posture. Since then, standing has been considered evidence of humans' intrinsic ability to negotiate creatively with gravity. 'Upright posture characterises the human species', writes Erwin Straus, well-known for his work on how this posture played a significant role in human evolution and development.¹

Although gravity may seem inconspicuous in our daily lives, its impact is such that our evolution would be unthinkable without it. Gravity has both burdened and inspired living beings, compelling humans, in particular, to develop various technologies to counter or negotiate its force. This has made gravity a key element in human development leading to changes in our perceptual capacities and a host of inventions, both pragmatic and poetic, like rockets, shoes and roller coasters.

Today, as humans have developed to be standing creatures, we create and enjoy a myriad of gravity-related activities. It should come as no surprise that most of these activities provide unprecedented forms and modalities of perception with corresponding aesthetic qualities. While gravity has always remained constant, recently we have been defying and experiencing it in extraordinary ways. One of the key drivers of technological development in our negotiations with gravity includes the pursuit of lightness and balance, manifesting itself in technologies like powered exoskeletons, orbiting satellites or even muscular fatigue blockers. They all create new possibilities for new types of locomotion and consequently new types of perception. Little by little, we have been raising ourselves away from the ground: humans stood up, took off and flew away, eventually reaching escape velocity and escaping Earth's gravity.

The capacity to counteract and appropriate gravity has been a vital and intrinsic feature of all living organisms. On the one hand, gravity has forced these organisms to develop skeletons and systems, from bones to muscles, which help to retain form and

overcome gravity-enforced size limits. On the other hand, gravity's downward force, which is constant and has a fixed direction, has been used as an appropriate cue for orientation and postural control.²

Nevertheless, humans have gone even further by attaining the ability to radically alter their relationship with gravity or even escape it. It is this new mode of gravitational life that made us homo sapiens.

The idea that bipedal locomotion liberates the hands and endows human beings with an intellectual advantage over all other creatures has been argued by many theorists. This idea can be traced back to classical antiquity and found in the writings of Xenophon, Aristotle, Vitruvius and Gregory of Nyssa.³ It was also commonplace among naturalists of the 18th and early 19th centuries, such as Charles Darwin, and has continued in the work of Erwin Straus, Andre Leroi-Gourhan and most recently Craig Stanford.⁴ For instance, Erwin Straus notes that the upright posture gave rise to a type of locomotion that would affect the development of human anatomy ('[G]ravity is never fully overcome; upright posture always maintains its character of counteraction. It calls for our activity and attention') and perceptual conditions (the particular 'gaze of upright posture'). These developments in turn gave birth to human characteristics such as self-awareness, intelligence, planning and language.⁵

Once we stood up we began to acquire the gaze of an upright being, offering broad perspectives and views on the world that would allow us to plan and order the environment. Unlike non-human primates who use their hands to move around, we humans found our hands liberated and could start playing around with our environment while inventing tools to understand it better and to harness or alter it for our needs. In other words, by erecting or raising the body away from the ground we literally moved away from 'nature' (by nature here I mean a previous non- or less technological state); or as Wills David, quoting Leroi Gourhan, puts it in his book *Dorsality*: 'standing upright the simian turned anthropoid and, in so doing, immediately turned technological'.⁶ Rather than

considering how human nature was confronted with technology, Wills suggests we imagine an overlapping of nature and technology that begins with a dorsal turn (the straightening of our back) – ‘a turn that takes place behind our back, outside our field of vision’.⁷ If technology is an integral part of the human, we must not forget that the impetus of such a technological development is the adaptation to a terrestrial environment governed by gravity.

‘To posit that man walks on two feet is also to posit everything implied by feet. That is where man begins: with his feet, and not with his brain’, claims Leroi Gourhan.[•]

If man begins with his feet, we are acrobats, that is, *high walkers* (acrobat in ancient Greek means high walker), possessing unique capabilities to defy gravity. A question arises: is the connection between this event of standing up and our great dream of flying or attaining ultimate lightness a coincidence?

Maybe ‘standing up’

was itself an expression of that dream. Whatever it was, the posture has had an enormous effect on what we are, what we desire and what we invent. ‘If the greatest human responsibility – both physical and moral – is the responsibility for our verticality, that makes us dynamically upright, that arches our body from the heels to the neck, that rids us of our weight, that gives us our first and only aerial experience! How salutary, comforting, marvellous, and moving this dream must be!’, Gaston Bachelard writes in admiration of vertical posture.⁹

Could we deduce that technological advancement might be largely driven by a tendency to lessen physical effort, lessen earthly life’s burdensomeness? Isn’t our upright posture already evidence of this hypothetical tendency? Marshall McLuhan asserted that technologies are a kind of materialisation of an economy of gesture – ‘the immediate expression of any physical pressure which impels us to outer or to

• Crucial to Leroi-Gourhan’s understanding of human evolution is the notion that the transition to bipedality freed the hands for grasping and the face for gesturing and speaking, and thus that the development of the cortex, of technology and language all follow from the adoption of an upright stance.⁸

extend ourselves, whether in words or in wheels'.¹⁰ Paul Virilio would add that 'the progress of contemporary technoscience is itself conditioned by the need to economise the efforts of the individual subject to Earth's gravity and therefore to the nervous and muscular fatigue resulting from his own mass and physiological density'.¹¹

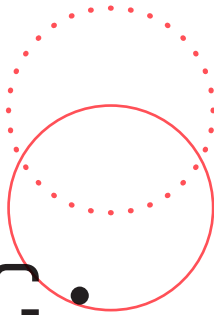
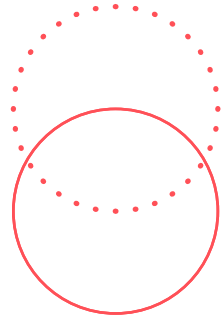
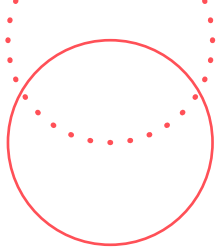
Aren't we bound inescapably to a gravity-driven surface in the absence of technological developments? Do such technologies – from shoes to spacecraft – that are used to lift us from this surface hint at an ultimate goal of leaving the ground entirely? And if we did lift off and away, what new human features would we develop?

Notes

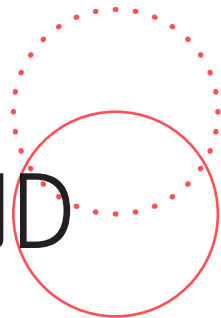
1. Straus, E.W. (1980). *Phenomenological Psychology*. New York: Garland, p. 141.
2. Clément, G. & Reschke, M.F. (2008). *Neuroscience in Space*. Berlin: Springer, p. 14.
3. Stoczkowski, W. (2002). *Explaining Human Origins: Myth, Imagination and Conjecture*. Cambridge: Cambridge University Press, p. 73.
4. Stanford, B. C (2003). *Upright: The Evolutionary Key to Becoming Human*. Boston: Houghton Mifflin; and Ingold, T. (2004). 'Culture on the Ground: The World Perceived through the Feet'. *Journal of Material Culture* 9, no. 3, p. 317.
5. Straus, E.W. (1980). Op. cit., p.141
6. Wills, D. (2008). *Dorsality: Thinking Back through Technology and Politics*. Minneapolis: University of Minnesota Press, p. 8.
7. Ibid.
8. Stiegler, B. (1998). *Technics and Time*. Stanford: Stanford University Press, p. 112.
9. Bachelard, G., Farell, E. and Farell, F. (1988). *Air and Dreams: An Essay on the Imagination of Movement*. Dallas: Dallas Institute of Humanities and Culture, p. 35.

10. McLuhan, M. & Lapham, L.H. (1994). *Understanding Media: The Extensions of Man*. Cambridge, MA: MIT Press, p. 181.
11. Virilio, P. (1995). *The Art of the Motor*. Minneapolis: University of Minnesota Press, p. 124.

JULIJONAS
URBONAS



FALLING:
THE ART OF
CONTROLLED,
SUSPENDED AND
DRAMATISED
TRAJECTORIES



*[A roller coaster] is as revolutionary, if not more so, than the greatest works of art.*¹

Despite having worked in the amusement park industry all my life, only recently did I realise that I suffered from a professional misfortune: I never liked to ride them, only wonder at them. My disinterest in submitting my body to funfair machinery perhaps lies in the fact that I'm quite motion-sickness-prone and that I grew up with Soviet-built amusement rides that functioned as communistic propaganda engines. • When I encountered American *theme parks*, a slightly different kind of engine generating huge sums of money by (dis)orienting people and making them love it, I was still wary of these rides. •• But then one day it all changed and my wonder turned to passion when I encountered extreme thrill rides.

I especially *fell* in love with the roller coaster, the virtuoso of space-warp. Of course, not as a fetishist (although there are people who have sexual relationships with roller coasters), but rather for the ride's unique and ambivalent aesthetic potential. ••• Be it impractical train, gravitational theatre, horror device, kinetic architecture, participative sculpture or a venue for extreme dating, basically, roller coasters are all falling machines driven by gravity and work by dropping a train from a height. Here, falling is not just a propelling force but creative material: it is suspended, exaggerated, twisted

• I literally grew up in a Soviet amusement park, which was headed by my father. The park was my substitute kindergarten and its employees – ride operators, event managers, technicians, cashiers, administrators – were my nannies.

•• Note the difference between amusement park and theme park: a theme park is differentiated from an amusement park by its various 'lands' or sections, each devoted to telling a particular story, whereas an amusement park's creative emphasis is put on kinetic bodily experiences without thematising them (Coney Island is a good example of an amusement park). The essence of thematisation lies in the priority of image over a phenomenological experience of space.²

By (dis)orientation I refer to two related meanings of this concept: (1) literal disorientation caused by dizzying devices and (2) simulacra (the reordering of history, the imitation of reality, the

and experienced with the whole body. The downward curve is no longer bound to a straight line – it is stretched, bent and entangled.

For the following pages, let us fall along a distorted trajectory, allowing the coaster's train to carry its peculiarities and unfold its aesthetic dimensions along the way. It will help to keep its essence 'on track'. I will visit *Shakeland*, a non-existent amusement park located about twenty kilometres from Klaipėda, Lithuania. The park is partly a thought experiment and partly a fiction. Actually, perhaps more accurately, we could say it is a quasi-real

place because what I will describe draws on experiences, moods and technical and scientific subtleties that are based on my own and others' experiential investigations of various amusement parks. *Shakeland* will allow us to encounter all this in a single ride.

I take my first steps into the park. I notice an extremely long queue for a roller coaster. It is the longest queue in the park for sure. It is obviously an extremely popular machine. And indeed, roller coasters are key machines for any amusement park as they are capable of producing the richest bodily experience out of all the rides. Consequently, roller coasters get the most attention and, at *Shakeland*, each one gets an investment of up to 50 million euros. What is so desirable here? I queue up to find out.

Long as the queue is, waiting feels short. And besides, the people in the queue can admire the spectacle of an extraordinary architectural machine: the roller coaster's elegant structures and the railway-like track span the sky as if its curves drew the trajectories of an aircraft's aerobatic flight. Thanks to profit motives, the queue moves quickly

establishment of pseudo-needs), which was extensively theorised by Jean Baudrillard. Used in the context of this essay, the term *orientation* means orienting or steering people in such a way that is most profitable in corporate or economic terms.³

... For instance, Amy Wolfe, a US church organist, has recently 'married' a roller coaster. Amy suffers from a rare condition called 'objectum sexuality' where people develop sexual attractions to objects. Amy rides the machine almost every day in a year and asserts that she derives sexual satisfaction from it.⁴

to get as many people on the ride as possible. And even if the wait is long, there is always a peddler strolling around selling a book specifically written for this unique queuing experience to help stop (apparently) the boredom of standing in line.⁵ In addition to the visual spectacle, the coaster might be experienced as a sound sculpture too. While the train follows its geometry, it makes a unique soundtrack produced both by the polyurethane wheels running on the steel railway and by the screams accompanying the sudden changes in the roller coaster's trajectory. Bizarrely, somebody abandons the queue with almost each scream. I suspect empathy with the screamers is terrifying enough to make the 'coaster-phobics' stay stuck to ground zero. But for me, and I believe for the majority of the others in the queue, it is even more stimulating.

Strapped to a seat on the coaster I'm slowly towed to the top of the first hill. This slow lift is important because it intensifies the perception of height. As objects on the ground get smaller and smaller, I have enough time to see how high I am and also to imagine a few fatal falls along the way. Any slight movement of the car makes my heartbeat drum faster. We are at the top! There are a few seconds – some screams from the other passengers emitted before we even drop make it clear that I'm not the only one terrified by the anticipation – and then the train is dropped right to the ground. Whirr... swish! A scooting gust of wind, goosebumps, vertigo... butterflies in my stomach... While the track straightens, the centrifugal force drives the car upward and I am pinned to the seat with my buttocks' flesh so compressed against the supposedly ergonomic (or butt-friendly) curves of the seat that my whole body is almost immovable (in 'launched roller coasters' this might be experienced even more extremely as the force would be horizontal)[•]. I wonder what happens to my innards when they are so pushed down like this? No doubt belonging to the horror genre, the roller coaster is all about threats

- Not all rides feature a lift hill, however. The train may be set into motion by a launch mechanism such as a fly-wheel launch, linear induction

to the living body: not only is any bodily movement difficult, if not impossible, to perform, but breathing is too. What is more, when it comes to enjoyment, even smiling, let alone laughter, is 'prohibited'. A gravitational paralysis!

Despite my 'frozen' body's condition, my heart starts violently pumping and distributing epinephrine (adrenaline) into my blood. • My blood and air vessels contract and dilate, and together they contribute to the 'fight or flight' response of the sympathetic nervous system. •• The central nervous system is constantly monitoring gravity and is so attuned to it that its responses can be imperceptible. Once extreme acceleration kicks in, however, we are suddenly well aware of this force. As my body prepares to undertake the threat of falling, I'm flooded with adrenaline; having undergone this momentary attack, I'm rewarded with a pleasurable bombardment of dopaminergic neurons. •••

John Allen, former president of the famed Philadelphia Toboggan Company, once said that 'the ultimate roller coaster is built when you send out twenty-four people and they all come back dead. This could be done, you know'. Freud would definitely attribute the desire to ride roller coasters to his concept of the death drive. Perhaps, then, the several million people per year in the US alone who submit

motors, linear synchronous motors, hydraulic launch, compressed air launch or drive tire. Such launched coasters are capable of reaching higher speeds in a shorter length of track than those featuring a conventional lift hill.

- Epinephrine is a 'fight or flight' hormone which is released when danger threatens. The 'fight or flight response' is our body's primitive, automatic, inborn response that prepares the body to 'fight' or 'flee' from perceived attack, harm or threat to our survival. When secreted into the bloodstream, epinephrine rapidly prepares the body for action in emergency situations. The hormone boosts the supply of oxygen and energy-giving glucose to the brain and muscles, while some bodily processes that are not vital to the response are suppressed.

- This fundamental physiologic response forms the foundation of contemporary stress medicine.

- The brain chemical dopamine has been thought of as the brain's 'pleasure chemical', sending signals between brain cells in a way that rewards a person or animal for one activity or another.

their bodies to the thrill of falling are in fact pursuing the death drive. Even many suiciders travel hundreds of miles to fall from landmarks that would provide a compelling fall, implying that there is also an aesthetic justification for the fatal jump. •

Not everybody considers this a price worth paying for the experience of some positive feelings, aesthetic or otherwise. Some people take the ride as a test of self (a self to which they may never return), while others become addicted to the experience. In fact, as

- The most popular locations in the world are reportedly San Francisco's Golden Gate Bridge, Toronto's Bloor Street Viaduct (before the construction of the Luminous Veil), Japan's Aokigahara Forest and England's Beachy Head.⁷

researchers are discovering, the psychology of risk involves far more than a 'death drive'. Studies now indicate that the inclination to take high risks may be hard-wired into the brain. Risk-taking is thought to be intimately linked to arousal and pleasure mechanisms and may offer a thrill so powerful that it becomes addictive. Psychologist Marvin Zuckerman presents convincing evidence that this characteristic has a strong genetic component nearly as strong as that of intelligence. This personality trait varies from person to person; some people need more stimulation than others. Ultimately, the need to experience risk appears to be a genetically driven necessity that makes it difficult to resist. The fact that roller coasters are everywhere in the US – the country of key safety inventions such as insurance, seatbelts, helmets, etc. – seems evidence enough. In unstable cultures, such as those at war or suffering poverty, people rarely seek out additional thrills. Roller coasters might be seen as thrill oases, sustaining a psycho-cultural equilibrium.

Let me come back to the fall. Soon after that paralysis, happily in just a few heartbeats, I'm allowed to breathe. Now, all of sudden I'm pushed right and left, left and right, not sure which side the car is going to turn. Sharp right with surprise! This trick is called 'trick track', invented by Harry Traver in 1927, one of the most famous roller coaster designers in history. By shaking laterally,

the trick track messes up anticipation and produces unexpected joyful responses. Although it might be easy to get used to the rhythm with one or few rounds, today, the surprise effect is amplified by applying chaos theory. Other types of coasters, so called '4th dimension' roller coasters, have 'loose' cars spinning along the horizontal axis independently from the track. They are driven only by the passengers' weight, the external or inertial forces created by the car's momentum. It's all governed by chaos theory, which means that the position and weight of everyone on the ride can influence the kinetic repertoire of the ride experience. Thanks to this trick, you'll never have exactly the same ride twice. In fact, it is so sensitive that even the state of its bearings can influence the ride.

Shortly after a series of the surprising trick tracks, I take a deep breath and the train rapidly climbs a little hill, the change in velocity producing negative g s at the top. •

Surprise, again! But this time, it is of a different nature. Being briefly lifted out of my seat, I experience the force pushing me upwards, which some roller coaster enthusiasts call 'airtime'. It produces an odd tickling effect in my stomach as if I tried to ingest a bunch of batteries electrifying my belly. This is experienced due to the change of the force of direction, pushing the stomach upwards (up to $-1\ g$), or as the result of the sudden decrease of the weight of the stomach ($\sim 0\ g$). The same thing happens when you drive down a dip in the road in your car or descend in an elevator moving at high speed.

Hop, right on the top of the 'airtime' hill – I'm

- The gravitational force, more commonly known as g -force, is a measurement of the type of force per unit mass – typically acceleration – that causes a perception of weight, with a g -force of $1\ g$ equal to the conventional value of gravitational acceleration on Earth, of about $9.8\ m/s^2$. Assuming you, the reader, are sitting at a desk and reading this here on Earth, the force of gravity is pushing against you in such a way that you are experiencing your 'normal' weight downwards. If it was $10\ g$, for example, the experience of your own weight would be ten-fold the usual. Thus $0\ g$ would feel weightless. But in the case of negative gravitational force, the experience of weight would be felt upwards.

weightless in a second. Plunge, and right into the loop-the-loop, a continuously upward-sloping section of track that eventually results in a 360-degree circle at the topmost part, completely inverting its riders. Its varying forces put my body through the whole range of sensations in a matter of seconds.

After the circular manoeuvre of turning the world upside down, my weight doubles, triples, quadruples... In the park's pamphlet, there is a technical description of the coaster. It says the maximum g -force should be 6 g , six times the force of gravity! Sounds like I might be experiencing sextuple gravity now: I weigh now almost a half of a ton! This should be more terrifying than the 'gravitational paralysis' that took place at the beginning of the ride, but in fact it is even milder, as it is very brief. By comparison, astronauts at liftoff pull under 5 g , while pilots of supersonic aircraft might experience a maximum of 9 g . Still, I can feel lucky enough to enjoy this mild loop in comparison with its ancestors of the late 19th century; these loops were either too small or badly shaped so that coasters going through them were subject to as much as 12 g . Many people fainted, and head, chest and leg injuries were common. • Such roller coasters featured a nurse on duty to deal with any complications from the ride.¹² Besides being too small, those early loops were perfectly circular and it is only quite recently (from the mid-1970s) that engineers – to be more precise, Werner Stengel – found that a spiral in which the radius of curvature decreases at a constant rate would provide the right geometry for a safe loop. •• Thus we have the modern, teardrop-shaped loop, known as a 'clothoid', in which the coaster can maintain a minimum of 0.6 g at the top, keeping riders in their seats,

- The cause of this, most probably, was G-LOC or g -force induced loss of consciousness, which occurs during high acceleration load on a longitudinal plane. Simply put, when the buttocks are pinned so extremely against the seat, the blood is pooled in the lower body extremities, starving the brain of oxygen.

- This type of shape was first introduced in 1976 by Werner Stengel in the looping roller coaster, 'Revolution' at Six Flags Magic Mountain,

without exceeding 6 g – and only approaching it briefly as it enters and exits.

California, USA. Anton Schwarzkopf had also contributed to the R&D of the shape.¹³

However, this rather extreme gravitational ‘score’ still feels gentler and less nauseating than the so-called ‘heartline’ or ‘barrel’ roll of the ride’s track. In this coaster’s element, the train twists but my heart stays roughly in line with the centre of the curve. The body spins around its heart – the head is disoriented, the pants stay on as usual. Dizziness is followed by a somewhat ambivalent shock upon my psyche, and my whole body is freaked out even more, placing my blood pump in a kind of clinostat. For those who believe in the existence of a weightless human soul with the heart as its locus, this experience should be ecstatic and revelatory.

After a few more swoops and sweeps I realise that each coaster’s element plays differently and variably on my body parts. As my body is not solid but composed of many loosely connected parts, each part of the body is accelerated individually and therefore interacts with each other in various ways. The layers of the muscle’s soft tissues are stretched forward, backward, trembling, waving to dissipate the energy across; the bodily fluids – blood, sweat, urine, the contents of the stomach – change their usual course and circulate to hitherto unexplored directions; tendons are tensed, relaxed, tensed, relaxed again, resonating in accord with oscillating gravity fields. The kinetic art of the flesh! Breathlessness, cold sweat, violent heart-beating, goosebumps, becoming hoarse from shouting are just a few ways to appreciate such gravitational art.

Now, I continue the ride with my eyes shut, which gives a very different experience of anticipation. It is both more and less frightening at once. Having no visual clues, I can’t tell the speed and anticipate what’s going to come next. This amplifies the terrifying sense of a loss of control. Opening my eyes again, I now understand that, in addition to the full-body sensations I’ve felt, the adrenaline-soaked ride is sharpened with all sorts of visual and aural

cues. Nauseating upside-down turns, spiralling corkscrews twist my entrails but also largely disorient – I can hardly keep track of where and how I am oriented in space. But even once I regain orientation, during those shifting moments from one ‘scene’ to another, I encounter closely passing structures and dizzying heights, which the tactile and kinaesthetic senses alone cannot possibly perceive as they are able only to sense the change in velocity, that is, acceleration. This disorientation, the terror of high speed, the fear of heights, are supplemented by the sounds of the wind rushing into my face, the screaming passengers, the chattering wheels of the train, the hardcore heartbeat – the music that twists the riders’ guts and makes them vomit! (Incidentally, especially frightening and unsettling sounds are those you get with the wooden roller coaster: the creaking, rumbling, clickity-clack noises, even if natural and inevitable because the wood flexes, give the riders the queasy feeling that the structure is about to collapse).

The fall feels as if it were endless, despite the fact that the momentum of the train decreases after the first drop. In fact, the endlessness is just an illusion. Designers are aware of this and work it to their advantage by throwing in curves, smaller hills and even tunnels to hide this decrease. They even exploit the few moments before the unloading platform, and the rider is subject to mini hills – the ‘bunny hops’ – which shake the car still quite violently and exaggerate the perception of speed.

I glance at my wristwatch – it is hard to believe, but this entire ride took less than a minute. Through the bombardment of fluctuating gravity forces and careful choreographing, time is suspended and the coaster euphoria turns out to be a celebration of instantaneity. But when it’s done, it rather feels like the adventure of a lifetime. • At the boarding station I look at my coaster-mate and we smile at each other as if we were old friends. She is no longer a stranger. And all of sudden I realise what

• In fact, such a distortion in the perception of time is common in all crisis-like events. Inspired by his childhood little mishap

brings us, and hundreds of millions of other riders per year, together: the allure of falling. The coaster is perhaps the world's fastest dating venue. How romantic that one can fall in love by falling! Unsurprisingly, psychologists find roller coasters conducive to romance.¹⁵ Making people queue up for such a short but extreme experience of falling together (or just allowing them to watch this), provides us with a unique platform for socialising – which might tell us something of the social order outside the park...

If there is any particular order being questioned, it is definitely the 'horizontal' way of life, the emancipation from which the curvilinear coaster guarantees. • The rider might find a set of physical experiences in aerobatics, acrobatics, extreme sports and dance, commonly not found in everyday life. The coaster experience offers a diverse set of unfamiliar, exaggerated and impractical interpretations of time and space. As a series of anticipations, climaxes and resolutions, further shaped by an exhilarating language of movement, the roller coaster makes for a unique narrative machine that engages the whole body. It also terrorises the innards and triggers a voluptuous panic on an otherwise lucid mind; I yell from fear as much from pleasure. It is pleasurable gravitational torture!

(falling from a building) and noticing that time slows down, neuro-scientist Dr David Eagleman set out to study this phenomenon. He has gathered a huge number of stories from people who have survived falls, car crashes, bike accidents, etc. Everyone, he says, seems to say the same thing: 'It felt like the world was moving in slow motion'. He found that memory is the culprit behind all this as it 'widens up' during such extreme situations, recording everything, including any apparently trivial perceptual nuance: I can, for instance, recall the odour of the fresh spring air and candyfloss, tiny dust particles coming from someone's pocket in the front row of the car, the subtle play of pressures around my body, flickering images of the sky and ground with their precise details, such as the shapes of clouds or people gazing at us, even fragments of daydreaming of how this experience might be domesticated – and so on and so forth.¹⁴

• By 'horizontal life' I refer to the plane or direction of mundane human movement. We sometimes jump, fall and climb, yet most of the time we move within quite a narrow and close to the ground horizontal plane.

The development of the designs for roller coasters and other thrill rides appears to be driven by machismo: they get taller, faster, more intense. That said, we might ask if these peaks of body stimulation and intensity have been reached.¹⁶ Perhaps the apogee was celebrated by Colonel J.P. Stapp – ‘the fastest man on Earth’ – who rode a rocket roller coaster that marked the very limits of human flesh. •

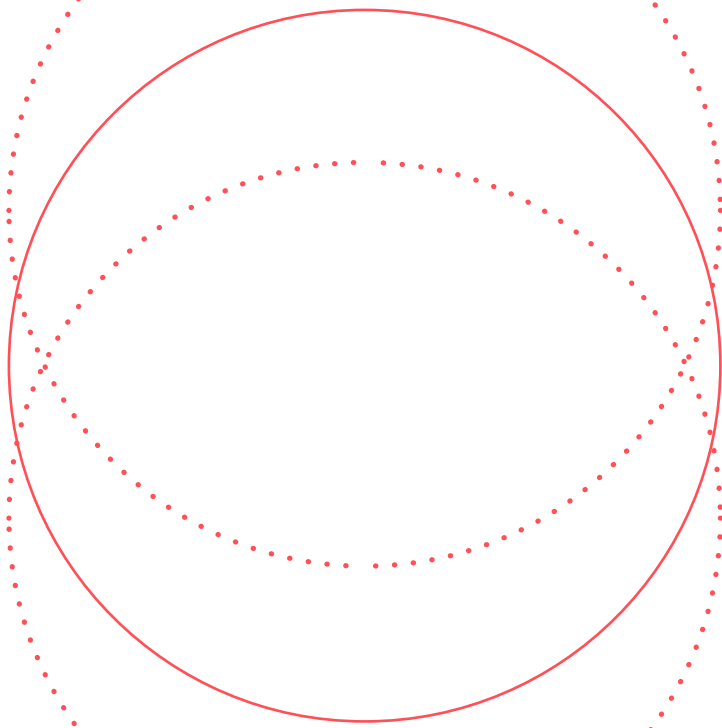
So as I experience the jiggling, jogging and bodily-stirring until I become aware of my own gut-deep embodiment, I wonder if these vehicular poetics boast a peculiar yet underdeveloped aesthetic potential. Such aesthetics would be based on egomotion or self-movement. Egomotion refers to how we relate to and perceive our own movements, especially when there are displacements between the perceiver and environment (egomotion should not be mistaken with ‘locomotion’ which refers to the act of moving, that is, to the means by which displacement is normally brought about, such as flapping one’s hands about in order to swim). The focus of a roller coaster’s design is precisely on this sort of egomotion-based aesthetics and it is worth noting that there are very few examples of similar aesthetic practices where egomotion is employed as the core means of expression. I can’t help but believe that this form of aesthetics could be nurtured into a new field of art. This might be a cure for the white-knuckle, macho approach to roller coaster designs we’ve had up until now. Such aesthetics might herald a new era for amusement rides (or could we say art rides?) in general. Let me call this *gravitational aesthetics*.

- In order to improve aircraft ejection seats, Dr (Col.) John Stapp (1910-1999) risked his life to test the effect of acceleration on the human body. In test experiments using a rocket sled, Stapp served as his own guinea pig. Stapp was subjected to more than forty times the pull of gravity (40 g), proving that the windblast and deceleration of ejection from an aircraft at 2,880 km/h and 10,670 m altitude could be survived.¹⁷

1. Lukas, S.A. (2008). *Theme Park*. London: Reaktion Books, p. 115.
2. Mitrasinovic, M. (2006). *Total Landscape: Theme parks, Public Space*. Farnham, UK: Ashgate Publishing, p. 74.
3. Baudrillard, J. (1996). Disneyworld Company, *CTheory* [online]. Available at: <http://www.ctheory.net/articles.aspx?id=158> [Accessed 27 October 2009].
4. Otto, S. (2009). Woman Getting Married to a Fairground Ride. *The Telegraph* [online]. Available at: <http://www.telegraph.co.uk/news/newstopics/howaboutthat/5972632/Woman-getting-married-to-fairground-ride.html> [Accessed 4 November 2009].
5. Wegener, S. (2003). *Theme Park Queues*. Amusement 4/Scottware.
6. Onosko, T. (1978). *Funland U.S.A.* New York: Arno Press, p. 59.
7. Wikipedia (2009). *List of Suicide Sites*. [online] Available at: http://en.wikipedia.org/wiki/List_of_suicide_sites [Accessed 29 October 2009].
8. Roberts, P. (1994). Risk. *Psychology Today*, [online] 1 November. Available at: <http://www.psychologytoday.com/articles/200910/risk> [Accessed 30 October 2009].
9. Independent Print Limited, 2010. *Interview with Marvin Zuckerman*. Big Think Podcast. [video]. Available at: <http://bigthink.com/marvinzuckerman> [Accessed 9 February 2010].
10. Roberts, P. (1994). Op. cit.
11. Brooks, M. (2001). View to a Thrill. *New Scientist*, [online] 28 April. Available at: <http://www.newscientist.com/article/mg17022884.900> [Accessed 22 December 2009].
12. Lukas, S. (2008). *Theme Park*. London: Reaktion Books, p. 109.
13. Schützmannsky, K. (2001). *Roller Coaster: The Roller Coaster Designer Werner Stengel*. Heidelberg, Germany: Kehrler, p. 120.

14. WNYC Radio (2010). *Falling*. [podcast]. Radiolab, 20 September. Available at: <http://www.radiolab.org/2010/sep/20> [Accessed 4 November 2010].
15. Meston, C. M. & Frohlich, P. F. (2003). Love at First Fright: Partner Salience Moderates Roller Coaster-Induced Excitation Transfer. *Archives of Sexual Behavior*, 32(6), pp. 537-544.
16. Brooks, M. (2001). View to a Thrill. [online] *New Scientist*, 28 April. Available at: <http://www.newscientist.com/article/mg17022884.900> [Accessed 22 December 2009]
17. The National Aviation Hall of Fame. *John Paul Stapp*. [online] Available at: <https://www.nationalaviation.org/our-en-shrinees/stapp-john-paul/> [Accessed 27 October 2020].

JULIJONAS
URBONAS



LEVITATING:
THE NONFICTION
(OR EXPERIENTIAL
REALITY) OF
LEVITATION



Levitation – in its enormous variety of incarnations, from the purest lightness of angels to the diamagnetic levitation of living matter – has been perhaps the most dreamed of and desired state of being. It is thread through the worlds of mythology, science fiction, poetics, science and technology. It is profoundly contagious and, like its opposite gravity, one of the greatest mysteries of physics and I'd dare say of experience too.

Desired as levitation may be, few can actually recount experiencing it in reality.* This is because

hardly anyone has access to and the knowledge of the technical requirements to have this experience. Fewer still (and probably no one) has experienced the full range of what levitation

* By 'reality' I mean tangible, non-imaginary and open for bodily submission or kinaesthetic exploration of the material realm.

can be. To fill this gap in knowledge, I have spent more than a decade familiarising myself intimately with various levitating technologies, embodying them and comparing their experiential subtleties.

Avoiding fantasies, myths, pseudo-science and even sometimes physics (at least partially), as well as allegedly (quasi)weightless phenomena like OBE (out-of-body experience), astral projection and the imagination, I'll try to bring to the ground the floating ideas about what it is like to levitate. Submitting myself to a series of bodily investigations of various levitation technologies – flesh hook suspension, neutral buoyancy, aerodynamic hovering, free fall and orbiting – I'll ask how we perceive the absence of gravity's burden and how lightness can become part of our 'naked' experience.** Such experiences usually require different bodily techniques, choreographies and technological prostheses to stabilise the condition (which is usually temporary), making each situation unique. Such paraphernalia and techniques complicate the (generalised) definition of levitation and makes me

** By 'naked' I mean the unconstrained sensation of lightness or an embodied condition of such an experience. For example, after practising cycling for a long time, the bicycle pulls out of the conscious foreground and is incorporated into the cyclist's

question the very possibility of experiencing pure lightness per se; I wonder if perhaps it is best to leave it to poets, illusionists and theoretical physicists to make levitation possible through our imagination alone?

But I don't want to come to such a conclusion too hastily. So, first I'll look into what it takes to get into levitation: (1) preparation, training or adaptation; (2) embodiment and attention to the technology that enables the experience; (3) how this technology changes our relationship with the body-environment by enabling new perceptions and parameters of experience. Each analysis will be conducted via spatiotemporal criteria that would resemble an everyday experience (we'll focus on 'naked' experiences). In other words, I'll try to live with or through levitation technology (henceforth lev tech), performing activities everybody does on day-by-day basis, such as sleeping, eating, defecating and having sex. I will not get into all the experiential details – that would take hundreds of pages. Instead, I'll focus on the experiential specificity and limits of each type of lev tech. After, I'll look into the common patterns that unify all these technologies, thereby defining what the experience of levitation could be.

body, becoming as 'silent' as her lungs and heart. In this way, cycling becomes a 'naked' experience. This kind of 'nakedness' is similar to what post-phenomenologist Don Ihde refers to as a 'ratio' between the objectness of the technology and its transparency in use.¹

Flesh Hook Suspension

Having done some research into levitation experiences, I decided to try flesh hook suspension. This is a ritual in which a performer is suspended by hooks that have been put through temporary body piercings and which uses the strength and resistance of the skin to remain elevated. I was determined to try it, although I was rather sceptical about the genuineness of the levitation experience and the spiritual, body modifying, pseudo-science associations that it has. I had heard how experiences of flesh hook suspension,

usually revolving around euphoric sensations, are shared across cultures, environments and people despite the fact that the ritual is approached with different preparations and intentions.²

Consulting some experienced suspendees online, I decided to hire a personal suspension supervisor. I'm told that I have to be prepared mentally and to be positively centred, because if I am frightened I can have a bad experience or even fall into a state of shock. Having no such problems, I become coldly detached and lie on a bed in my supervisor's 'hook lab'. He inspects my body to decide the placement, number and size of metal hooks (these are often deep-sea fishing hooks with the barbs carefully removed). Finding the proper hook placement and number involves a great deal of experience, knowledge of physics and an acute understanding of human anatomy, physiology and the durability of the individual's skin. If the number of the hooks is too low or distributed unevenly, the suspended individual's skin might be unable to withstand the body's weight and can rip. I'm going to be suspended in a horizontal or 'Superman' position, which is often performed by beginners. This is because the body's weight can be distributed across more hooks (usually about twelve), placed around the shoulders, upper arms, back, thighs and calves.

The supervisor starts inserting the hooks. My hook master pinches a small portion of my skin and pierces the first sterilised hook. Oof! Painful. Well, in fact, anticipation is more painful than the act itself. My supervisor says that once I have undergone this torture, I'll be rewarded. After about twenty minutes of this slaughter, I am slowly and carefully lifted off the bed with a block-and-tackle device. To be honest, this is the worst part: as the weight starts stretching the skin, I start to feel the true nature of this very intimate and alien penetration into my body. It is quite a shocking experience as it is burning everywhere and on top of that I'm becoming aware of the absurdity of this ordeal, which makes me dizzy. But hanging for a few minutes, sighing deeply and trying to soothe myself with thoughts of my (scientific) intentions here, I have

an extraordinary experience as the pain fades away and the body becomes lighter. Do sensory overload and pushing the body to its limits trigger an out-of-body experience?³

It is truly amazing and I have some sense of levitation thanks to either the mental (because of the intensity of experience) or physical (because of the distribution of weight across the body) effect, or maybe both. Trying to explore this experience further by increasing my motility is constrained by the ropes, as they can easily get in a tangle, and by the number of the flesh hooks. In other words, *the magnitude of weight distribution – the unit of lightness – is adversely proportional to the freedom of movement*. Light but stiff. Another feature of this levitation is its ephemerality, as it lasts a maximum of one hour (and after, you have the ordeal of waiting for the skin to heal before you can participate in another session. Truly, the enlightened ‘pays the physical penalty for being suspended’, as the Australian artist Stelarc once commented).⁴

All in all, it is a very unstable levitation indeed: on top of the mobility constraints and its temporariness there is an experiential variation between individuals. On one end of the spectrum, there are people that enter a trance-like state or can feel a meditative lightness and sense of spiritual inspiration, feeling no pain whatsoever; on the other end, there are those who experience extreme pain, nausea and panic attacks – perhaps ironically, a heightened awareness of gravitational pull. As for me, I’m perhaps somewhere in the middle of the spectrum.

Buoyancy

In 2005, I visited ‘INERS_Double and Microgravity Positions’, an exhibition by Hungarian artist Antal Lakner, at Trafó House of Contemporary Arts, Budapest, Hungary. There I come across *Black Hole*: a black box-shaped booth with a door on one side and a table full of makeup stuff with a mirror next to it. Responding to my face radiating with curiosity, an elderly lady standing in front of this booth and

dressed like a nurse tried to inspire me further: 'Hey, boy, want to experience zero gravity? Strip naked!' I was amazed: this is exactly what I was looking for, a 'naked' experience of lightness!

All of sudden I realise this booth is, in fact, a redesigned floatation tank.[•] Having not experienced one before, I accept the invitation, provocative as it is (not least because I have to undress in a gallery space). I take a shower and get into the soundproof and slightly illuminated capsule. There is a mini pool filled half a metre deep with highly salinated water at skin temperature. I lie down and switch off the light. I float indeed! Thanks to the added Epsom salt (magnesium sulphate), the density of the water rises above the density of the human body, making me float with my face above the water. My ear-plugged ears are submerged and hearing is reduced. It is extremely calm – no sound, no tactile stimulation, no smell – and it doesn't take long before I feel as if I am dissolving in this liquid. It is an eerie experience and I even shake myself a bit to enliven my body.

Having reached somewhat the state between daydreaming and sleep, I start to notice that in fact there is something in this nothingness. My body, the pulse of my heart and the mild, windy sound of respiration play a live concert with the buzz of tinnitus in the background. Sometimes I feel itchy and find myself fidgeting (as those who have practised meditation may have also experienced). These tiny gestures often cause propulsion and I bump into the wall, the border of the levitation experience.^{••} After a few tiny bodily technique tests, I find that the small waves caused by my breathing can help centre myself in the solution. Nevertheless, maybe because it requires more practice, my daydreaming or rather

• Originally designed by neuropsychiatrist Dr John C. Lilly in 1954 an isolation tank was used for testing the effects of sensory deprivation. It is usually a lightless, sound-proof tank in which subjects float in salted water at skin temperature.⁵

•• In fact this problem might be prevented by a ring heating system which is used around the outer walls of more advanced tanks to warm the water so that it rises up the outside edges

levi-dreaming is constantly disturbed by the slightest movement. I realise that this floatation experience is constrained not just by the walls of the tank but also by my motoric exploration that is limited by the fact that in order to float I can only engage in micro-movements and stay in a lying position.

Hoping to improve this buoyant experience, I sign up for a professional diving course. Specifically what I'm looking for here is to learn how to achieve neutral buoyancy, a holy grail of diving. Neutral diving is when you neither float (positive buoyancy) nor sink (negative buoyancy) but remain at a constant depth. •

Professional divers call it a unique art form in its own right. And as such, it is extremely hard to learn – it takes me more than twenty dive sessions just to get acquainted with it. But it is worth the time and energy devoted to it and now I understand what my tutors are calling 'underwater flying'. In neutral buoyancy I feel extremely light: diving is so effortless, as I am not fighting to stay off the bottom or to stop myself from rising to the surface. And what's more, I breathe less air so I can extend my underwater exploration time without changing the air tank. But, again, it requires a considerable amount of time to learn to do this. And it proves to be almost impossible to teach; you can really only learn by practising a lot.

In order to remain neutrally buoyant, I, as well as most divers, use a buoyancy compensator (BC). BC is a wearable diving device, which allows the user to control depth by adjusting its volume, or more technically put, the amount of gas in the device's

of the pool, travels towards the center, and then sinks under the tank user. This very slow water convection flow helps to keep the user centered in the middle of the pool, stopping them from floating to the side and bumping into the walls of the small tank during long float sessions.

- Due to its similarity to weightless space, neutral buoyancy allows the person to simulate some space activities such as spacewalking or Extravehicular Activities (EVAs). It's for this reason that astronauts or cosmonauts have to complete part of their training in a space station immersed in a large pool.

artificial bladder. I inject more gas into the BC when I am too heavy and start sinking and vent it when I'm rising. This is the most common technique and it can accommodate divers differing in bodily physique (the overweight tend to float and the muscular to sink) and different waters, whether saltier or with warmer streams. You have to carefully coordinate your movements to avoid any change in depth from the position of neutrality (a bit higher and you start to ascend, lower and you descend) and even small changes in lung volume through breathing. Together with the regulation of BC, you have to learn subtle lung gestures: inhaling deeply causes you to rise, while exhaling, to sink. Thus, the maintenance of neutral buoyancy must be a continuous and active procedure – the diving equivalent of the balancing act of a tightrope walker.

Neutral buoyancy is somewhat similar to flesh hook suspension in the way it distributes weight and how the resistance to gravity is felt across the body. However, they differ in the directions of force: the former pulls the skin outwards, whilst the latter pushes the body inwards. As for the experience, this underwater weightlessness differs significantly. Perhaps the most noticeable difference and advantage is the freedom to move (to a degree) and the way in which the whole body is engaged. Underwater, I'm free to dive in all directions and take very little effort in propelling myself horizontally, although I am quite constrained to the level plane and lying position because it's harder to remain stable in neutral buoyancy in a vertical posture. The time taken to learn and to maintain this position underwater is another feature and a disadvantage. To be *stable* I have to coordinate my bodily-technological relations in a fluid environment. It involves subtle lung contractions, whole-body movements (especially those fluttering gestures of the limbs), awareness of the skin's sensitivity to water pressure and the regulation of the BC's and gas tank's volume. And all this is done in slow movements due to the fluid drag on bodily movements. This means that quick movements are very *heavy* and hard, if not impossible,

to perform, which is also an intrinsic feature of neutral buoyancy-based levitation. Only after extensive practice and negotiation with this kind of levitation, can one move more fluidly and automatically.

Nonetheless, this is not a 'naked' phenomenon. As much as I could get used to these special technologies (wetsuit, diving mask, fins, buoyancy control device, lead weights, breathing equipment), balancing this buoyancy effortlessly and automatically is still very temporary. What is more, without any additional oxygen supply, I can stay underwater for a maximum of just a few minutes. That said, the world record for holding one's breath, or what is more precisely known as 'static apnoea', a stationary breath-holding technique, is 11 minutes and 35 seconds, while the current record for the world's longest scuba dive (Scuba is an acronym for Self Contained Underwater Breathing Apparatus) is about ten days. •

Unfortunately, such long stays underwater while sustaining neutral buoyancy are hardly imaginable. And any longer stay would have to do without basic human needs such as food, hygiene, social communication etc. The longer you float, the heavier the habitation becomes. In my case, the experience ultimately remains 'light' or 'transparent' for only a few minutes.

• The record belongs to Stephane Mifsud who mastered it on the 8th of June in 2009. The record of 240 hours belongs to Cem Karabay.⁶

Aerodynamic Levitation

In the past, I had done only one parachute jump and a few bungee jumps, so I don't feel able to comment on these technologies in terms of levitation or lightness. Besides, my experiences there were too momentary for more rigorous experiential exploration or analysis. Willing to enrich my falling experience, I approach my friends, recipients of numerous awards in various parachuting and skydiving contests, to discuss their parachuting experiences. To make our discussion fuller and empirically backed they invite me to a vertical wind tunnel to try aerodynamic levitation.

Vertical wind tunnels are tall tunnels in which air is blown vertically from a powerful fan beneath a latticed floor. Such tunnels are also called skydiving simulators as the sensation they produce is extremely similar to that of skydiving, enabling people to fly in the air without planes or parachutes. The wind moves upwards at approximately 195 km/h (120 mph or 55 m/s), the approximate terminal velocity of a human body falling belly-downwards, although this can vary from person to person. • This human body ‘floating’ in midair in a vertical wind tunnel is called ‘bodyflight’.

My first steps into the tunnel are far from bodyflight – as soon as the wind starts, it raises me almost a meter and I’m already falling down, staying in the air no longer than a few seconds. Despite the advice of my friends to stop, it takes me at least a dozen of these Icarus-like failures to understand that the body’s posture and the position of my limbs are the key to *stabilising* floatation, as well as engaging carefully in any descent or ascent and even generating turns, lateral motion and other acrobatics (or rather aerobatics?). At first glance, it appears as if there is no need for physical effort, but in fact, it requires quite an athletic physique and deliberate training to learn how to use one’s body effectively in this way. Once you learn these techniques, however, you are free to explore space in all dimensions (well, almost: in the tunnel, exploration is constrained by the walls; with real skydiving, by the limits of falling time). The whole surface of the body plays a major role in navigating this experience. Air friction differs with subtle turbulences between various parts of the body. The air strokes the surfaces of the skin, propelling the body upwards while clothing it in a kind of ‘air dress’.

• The terminal velocity of a falling body occurs during free fall when a falling body experiences zero acceleration because of the retarding force of air resistance. Air resistance exists because air molecules collide into a falling body creating an upward force opposite to the force of gravity. This upward force will eventually balance the falling body's weight and the body will continue to fall at constant velocity known as terminal velocity.⁷

This unique interaction between the rushing air and the shapes of the body is responsive and subtle. Any slight movement of a limb or even a finger can make you radically change position or trigger uncontrollable turbulent spinning. An uncountable number of attempts to take a nap while on the way down were all a failure due to the limited repertoire of these air-friendly movements. Doze off and you are no longer in control of your body.

My parachutist friends and I discuss free fall in actual skydiving. For about the first twenty seconds after jumping out of the plane, I briefly experience weightlessness. After that, the acceleration decreases to null and the falling speed remains constant, although it can be altered by manipulating the position and of the body and limbs. For instance, after years of skydiving practice, I am able to increase speed considerably by diving headfirst with my arms against the sides of the body, legs held firmly together and toes pointed. This posture presents a minimal projected area perpendicular to the direction of motion thus reducing aerodynamic drag. Special helmets and slick bodysuits reduce drag even further. Nonetheless, far from the experience of levitation, you feel your guts and bodily fluids being pulled by gravity, especially during rapid changes in head-up to head-down orientations.

The main problem of experiencing weightlessness here, in general, is air resistance and, of course, the limited time of falling. If these were overcome, true lightness would be possible. At least theoretically. And this is possible in parabolic flights.

Free fall

Still dissatisfied with my current experience of weightlessness and encouraged by my friends, professional fallers no less, I head to the Yuri Gagarin Cosmonauts Training Center in Star City (Zvyozdny gorodok, Russia). The centre is responsible for training cosmonauts for their space missions and they have also trained candidates from other countries of

the former Soviet bloc. Among many training facilities, the centre features 0 g training aircraft, the only means for simulating weightlessness without leaving the earth behind. It is exactly what I'm looking for.

The aircraft achieves weightlessness by following an elliptic or parabolic flight path relative to the centre of the earth. While following this path, the aircraft and its payload are in free fall and are literally orbiting the earth. During this time the aircraft does not exert any g-forces on its contents. These aircrafts are nicknamed 'vomit comets', and I get enchanted by the name and take a ride. I can hardly recall my first few sequences of zero-g, but I do remember the initial shock upon my sensorium. Breathing deeply and concentrating on my very being, I gradually start to explore this highly intense experience. After a few moments of violent and clumsy attempts to move in space, I encounter true weightlessness. The experience reminds me of a passage from the American writer Paul Auster's book *Mr Vertigo* (2006), a novel about an orphan boy who was taught how to levitate by a quasi-religious master. The passage where the boy finds himself hovering a few inches above the ground depicts the experience so vividly and accurately that it makes me want to steal the words:

'[I] grew still, almost tranquil, and bit by bit a sense of calm spread through me, radiating out among my muscles and oozing toward the tips of my fingers and toes. There were no more thoughts in my head, no more feelings in my heart. I was weightless inside my own body, floating on a placid wave of nothingness, utterly detached and indifferent to the world around me [...] Very slowly, I felt my body rise off the floor. The movement was so natural, so exquisite in its gentleness, it wasn't until I opened my eyes that I understood my limbs were touching only air, [and conscious] only of the air fluttering in and out of my lungs'.⁸

After, when he finds himself lying on the ground, the boy feels his body dull and turbid and can hardly get up – it is exactly what happens in

a 'vomit comet'. Weightlessness is accompanied by double gravity – quite regular sequences of twenty-second sessions between 0 g and 2 g. This, in a way, heightens this sensation of lightness. Weightlessness is entered and followed by the double load, during which my weight is doubled and any bodily movement is slowed down as it requires a solid conscious and physical effort. In fact, what is changing here is just the aeroplane's acceleration and relationship with Earth's gravity – but what an effect! It is this intertwined spectacle of altered states of gravitation that allows me to learn what a significant impact gravity has upon us.

What Mr *Vertigo* misses in the description of weightless experience is vertigo itself: giddiness, loss of balance and a temporal loss of the sense of orientation. It's unsettling, I feel like I'm stepping out into the void and yet I don't fall, like floating at neutral buoyancy without water. When you fall, there's a spatial reference: you fall down from somewhere to elsewhere. But with this kind of weightlessness you fall without falling; there is no perception of displacement. Freed from gravity, I also liberate myself from the usual references of orientation – there are no longer such things as vertical and horizontal or up and down – all points and directions are equally significant.

Such sensorial bewilderment, worsened by anxiety, usually results in airsickness: dizziness, nausea, shock, vomiting or combination of them all, which mostly occur after five to ten parabolas. My own disorientation and dizziness and, even more radically, my ultimate submission to levitation, weirdly make my bodily boundaries disappear. It is a sort of dissolution into the void – an experience of nothingness! Fortunately, thanks to my natural fidgeting, I am reminded of having a weighty body.

Still fiddling with my disorientation, I am brought back to a state of self-awareness and come to a little discovery of how to orient myself in space. If I close my eyes and make several somersaults, I find myself even more disoriented as my cognitive powers go wild in trying to anchor

a reference point. Thankfully, once I open my eyes, everything settles down and I'm certain the cushioned floor is 'down', the ceiling is 'up'. In fact, I'm free to build space as I want to: when I turn myself upside down the floor becomes 'down'. Nonetheless, one reference source is constant: my own body. This insight or, one could say, my little architectural discovery, maybe is a bit solipsistic, self-centred. However, it is empirically supported by the fact that my head points in an *upward* direction, the legs *downward*, the hands laterally *left* and *right*, whilst my chest is oriented *forwards* and so on. Thus, I, and probably all of us, 'wear' a reliable and stable set of reference coordinates or what French choreographer Kitsou Dubois calls 'subjective vertical' – a heritage of our evolutionary negotiation with gravity – all the time, regardless of our relations of the surroundings. •

In these circumstances locomotion also has to be re-discovered. There are no longer such bodily activities as standing, kneeling, getting up, etc.; familiar movements lose as much meaning as function in 0 g. For example, the legs lose their bonds to their terrestrial locomotive function and become equally significant as the hands. As a result, some new motions emerge that are impossible on Earth.

I can quite easily execute movements that are like those of a yawing, rolling, pitching aeroplane; I can fly quite far just with a gentle lean forwards; I can perform a somersault in all three angular directions. All this, however, requires subtle coordination, orientation in space and an awareness of a peculiar inertia unique to this state of weightlessness. In the aeroplane, next to me a few cosmonauts are being trained and it is not hard to notice their movements are far more fluid and acrobatic than those who are taking this ride for the first time and who wriggle and convulse uncoordinatedly. A careful, choreographic habituation to this environment is clearly required.

• The choreographer is known for her dance experiments in the weightlessness of parabolic flights.⁹

I conclude that this type of levitation is thus far the most unstable I have experienced and researched. There is no lightness without weight as every phase of 0 *g* is followed by 2 *g*; there is no movement without touching a stable surface and being aware of one's own inertia, a product of mass; there is no effortless locomotion without deliberate training or acclimatisation; there is no orientation without disorientation, nausea or vomiting; and finally, there is no emotional lightness or stability without overcoming *psychological* weight. •

Orbiting

Extremely luckily, during my PhD, I am approached by White Knuckle Inc., one of the world's biggest amusement park engineering companies, to discuss my research and possible applications for future amusement parks. And more than extremely luckily, after several stimulating talks, they decided to fund my flight to the International Space Station (ISS) to investigate future possibilities and the experiential potential of weightless entertainment. Yes, I go to space!

Living in a space station is the best weightless experience anyone might ever have and the ultimate material for this investigation into levitation. Therefore, let me go straight to space, skipping the tough astronaut training I've had to undergo and rigorous educational sessions about various aspects of space missions. Officially, I'm recruited as a space ethnographer and my 'job' will be to observe my space-mates' daily activities, behaviour, interpersonal relations, etc., without intervening too much (they are, after all, engaged in serious scientific work). But also, and more importantly, I'll be free to daydream and play with weightlessness as much as I want. This extraordinary privilege has probably never been granted in the entire history of space inhabitation. For instance, as a rule, astronauts or cosmonauts

• In fact not everybody masters it: 'There was a case when a client onboard asked the crew to stop making parabolas after just two of them', says Col. Nikolai Grekov, a former cosmonaut-candidate and the chief of Cosmonauts Training in the Conditions of a Hostile Environment.¹⁰

inhabit space stations to conduct various scientific experiments that fill their strictly and tightly organised daily schedules, leaving little or no room for free time. There isn't the time to play around when you must rigorously go through predetermined and detailed checklists of spacecraft life supports and hardware.

So, while I'm already floating here in the ISS, I feel I need to say a few words on what frees me from the pull of gravity. In fact, the experience is deceptive as gravity is still pulling the orbiting spacecraft. It circles around Earth at a certain speed (about 27740 km/h) producing a centrifugal force sufficient to cancel out the gravitational force. In other words, as the space station follows the curvature of Earth it is always falling but never hits the ground. It is this endless fall that allows its inhabitants to experience weightlessness.

Here weightlessness (or to be more precise, the experience of it) is substantially different from anything I've ever experienced. That is because this experience of weightlessness lasts far longer than its earthly counterparts, leaving me plenty of time to investigate it and, even more so, to *live* it. I can hang out, sleep, eat, use the toilet while levitating!

It is my first day and I can already confirm that the feeling of lightness is genuine. Indeed, if I close my eyes and let myself relax and 'dissolve' in this emptiness of gravity-free being, the boundaries of my body disappear, just as with some of my previous 'levitations' but in a more vivid way. However, when it comes to more sophisticated bodily investigations – movements and locomotion – I feel very clumsy. It is not light at all! I try walking, swimming, flailing, flying movements to propel myself... nothing helps... hands and legs are equal here and our earthly choreographies do not work in the same way in this environment. I simply float around helplessly and hit everyone and everything (and there is a lot to hit as every corner and surface of the walls of the tube-shaped space module is hung with hardware, cameras, food packages, bags full of

clothes, logs...); I make a floating mess and gather a collection of bruises in the process. I am not surprised that some animals that were flown into space never got the hang of it. •

After these ‘space walking’ failures, I start to discern the radical difference between the station-mates who have already lived here for

- For example, one set of new-born quails couldn’t adapt to life aboard Russia’s Mir space station and died after just a few days.¹²

more than several weeks and the newcomers, including myself. The veterans are diving through compartments and turning corners with such speed and grace – sometimes at the same time as writing their logs! – that I can’t help but think of their agility and light-footedness as extraterrestrial choreography. Yes, this is space inhabitation indeed. Mimicking them and learning from my mistakes, I soon find myself to be more confident enacting smoother movements. This is because I become aware of the importance of the body’s centre of mass to bodily coordination. To find the precise location of the centre I just try to perform a pure rotation along one axis. The basic physics I learned at school are of vital importance here, at last. If the direction of your push-force is not in a plane perpendicular to the axis and through your centre of mass, you will set off a rotation on more than one axis. By stretching out and rotating along one axis, I discover that my centre is just above the hips. I find it is best to keep my hands by my hips when exerting forces and boldly go headfirst, in a Superman-like manner. This way, my pushing and pulling are directed through my body’s centre of gravity – *a stable reference point of bodily movement* – and gives nice controlled motions without unwanted rotations. Now, I no longer hold my arms over my head to grab onto and push off from things as they come whizzing by. When I did this, I invariably imparted some unwanted rotations which had to be compensated with ever more pushes and pulls so that I ended up grabbing various fastened things, such as cords and cables, along the flight path and used them as handholds, pulling them out of their receptacles.

Lightness comes back when you manage to negotiate lightly the cramped spaces of the station. Here, effort is configured around delicate and subtle bodily gestures, like the gentle push of a single finger. No sound is produced but there is an almost undetectable mild wind raised by your flight. No trace of one's commute is left behind. No fastened object is touched, let alone loosened. Nor are the crew-mates aware that you are passing by their backs.

However, again, the alien choreography is not free from disorientation. Sometimes, by turning around and forgetting to fix my gaze on a discernible feature of the interior or by getting into another compartment in some awkward spinning manner, I lose my sense of orientation. Much more frequently, if I don't strap or *stabilise* myself to some part of a wall while staying in one place and writing my log, for instance, I float around unaware and change my relation to the surroundings causing disorientation. It's worth noting, this happens quite often, as any slight movement, even a tender breeze produced by the air ventilation system, might dislocate or change the body's orientation. If I am unsecured while interacting with a fixed object, even the slightest touch will send me floating away or get me in a twist. I try to open a fastened bottle, for example, only to find that I end up twisting myself instead. And then, the very process of trying to get 'oriented' or find something takes three or more twists and turns to get my bearings or understand what I'm looking at as any substantial bodily turn changes the perspective on things and the interiors making them seem different and unfamiliar.

Should this 'perceptual breakdown' occur, I find anything close to 'stable' in my field of vision – something which retains its discernibility even from different perspectives. I then use this as a reliable and fixed reference point. This problem of losing one's bearings has been known by space psychologists since the very first space habitation missions, and space architects and designers try to counter this by differentiating the walls by colour while carefully positioning the lights and developing

the shape of the module. Taking advantage of that, I pick or designate lights as 'up', for example, and everything comes into order: I am reoriented or *coupled with my environment* and do not feel any inconvenience from the fact that I might be walking on a wall or a ceiling. I should say that it would be wrong to say that all directions are equal in space because the orbiting station is subject to its gravitational tug – the reference source of all directions. But also, from a psychological point of view, Earth could be considered as the fixed reference point: I and my space colleagues love occasionally glimpsing Earth through the porthole and thus mentally anchoring this direction as 'down'.

'Any place in free space could serve as an excellent bed or an excellent chair', wrote the Russian visionary Konstantin Tsiolkovsky in his book *Free Space* in 1883, predicting what the state of weightlessness would be like for the first time in human history (he also predicted rocket propulsion, space-suits and space food).¹³ It is true and I like to play with where to place my bed. Sometimes I hook my space sleeping bag on the 'floor', sometimes on the 'ceiling'. In any case, it has to be in line with a ventilator fan which will ensure I have sufficient supply of oxygen. Otherwise I may end up sleeping in a bubble of my own exhaled carbon dioxide and suffocate, because, unlike on Earth where gravity does the job, in weightlessness, these gases, including those of flatulence, have to be separated artificially. • If

I sleep untethered, floating free, usually I am woken up by the collision with my own hand or with an air filter that is trying to suck me into its grill (by the way, all loose things tend to gather here – it is a perfect place to look for your lost belongings). • •

This effect of being suspended in the air affects everything, including all

• In fact meteorism is a double problem: it does not only tend to stay in one place but this intestinal phenomenon is quite persistent as digestive gas cannot 'rise' toward the mouth and is more likely to pass through the other end of the digestive tract – in the words of Skylab crewman-doctor Joe Kerwin – 'very effectively with great volume and frequency'. Happily, this problem

the other daily rituals such as meals, hygiene, going to the toilet. I have to be extremely neat and well-coordinated because otherwise (very easily) things loosen and get lost, which not only messes up your surroundings and makes it difficult to clean, but also poses a threat to air filtering equipment, since they can contaminate or clog the vents, as well as to the astronauts' respiratory system, their eyes, mouths or noses. Therefore, while brushing my teeth, for instance, I have to keep my mouth closed to prevent the toothpaste foam from getting out. In addition to this specific oral technique, I hold a piece of cloth with another hand to scrupulously capture any stuff that escapes and then I transfer the dampened cloth to a plastic bag and seal it carefully. It is pretty much the same with food, where the food must be sticky and can be safely moulded so it doesn't fly away in bits. Despite these precautions, I, as well as many other crew-mates, manage to find a thrill in 'risky' food: collecting swarms of peanuts with one's mouth, using a straw to penetrate a hovering, wobbling blob of coffee with a sugar cube dissolving in its centre or forming micro celestial bodies from hovering blobs of different drinks. But, again, this is done with the exclusive caution that applies to any other similar activities such as shaving, taking a shower, defecating (although a type of vacuum cleaner does the job there, not mouths and straws).

Besides becoming increasingly weary – the very result of the loss of weight – there are other and no less ominous concerns: the loss of muscles and bones, the shrinkage and slowing down of the heart, a drop in blood plasma, etc. To partially compensate for this lack of a weighty life, there are some countermeasures such as special nutrition and workouts – usually jogging strapped on a treadmill for a few hours every day. Happily, these bodily changes are not so explicitly felt. For example, as my

is weakened by another trouble: a degraded sense of smell.¹⁴

•• The astronaut's relaxed body tends to curl into a foetus-like posture – the arms are floating in front of the face and the legs in a semi-curved position in which the push and pull between the different muscles are evenly balanced.

(and of course others') spinal column expands and grows taller sometimes by up to 8 cm, I feel just a mild backache and a bit of discomfort. Less painfully, my fingernails seem to grow faster and hair longer. The hair grows longer not only on the top of my head but also on my arms and legs. As my feet are no longer used for their heavy terrestrial job, the calluses on my soles soften, hang on in there for a while, then peel off gradually only to flake off profusely at the end of my stay... turning my feet into baby ones. Our faces here become puffy and expressions become difficult to read, especially when viewed sideways or upside down. On top of these facial distortions, the voice pitch and tone change becoming more nasal, thus contributing to some troubles in interpersonal communication. Eventually, after a substantial amount of time, all these effects of the natural adaptation of the body to weightlessness become less noticeable, almost 'natural'. What was considered 'normal' in terrestrial 1 g becomes alien, especially on one's return.

And so, having come back to the ground, I feel the crushing force of my own body and I have an enhanced awareness of weighty corporeality. I can't even walk without assistance. Things appear as if in a slow-speed animated cartoon and I feel dizzy, even faint several times. • I find it difficult to concentrate and to speak coherently.

It takes me several days to recover as well as start walking again on my own and only in a well-lit space. I had only just

- The speed at which the eyeball moves for discerning an object is not the same in the weightless condition as on the earth.

learned to rely on visible spatial cues in the space station and eventually they became thoroughly incorporated into my perceptual mechanism, so back on Earth if I close my eyes I can find myself suddenly falling flat on the ground. Nonetheless, it does not take too long to return to the state I was at before the flight, except for a few trivial long-term effects, one of which is letting things go in mid-air and being surprised when they crash to the floor.

All in all, the experience of lightness and levitation in this orbiting habitat, is to date, the

best available to humans, both in terms of duration and the freedom of bodily investigation (admittedly, the space is cramped, so moving around is limited to a few meters, and, of course, this is a highly privileged experience that only a few hundred people have enjoyed).• Being out there is a truly light existence, especially when one gets the hang of a

careful coordination of bodily movement, perceptual acuity and technological know-how. What is to be noted is that the awareness of the weightiness of my body is not completely absent; it manifests itself in the in-

ertia caused by the fact that the body still has a mass at 0 g. Thus weight does not just disappear completely but is discernible even more, especially in the 'side effects' of the body's adaptation, including disorientation and bodily fluid redistribution. It is also discernible when compensating for such effects, for example with workouts or with bodily re-orientation to visual cues, both of which are the vital surrogates of gravity, and which only go to show our life-critical bond to gravity.

The whole experience also requires an enormous amount of technological sophistication to create an entire closed ecological system to support human life in space. This involves not just limiting the number of activities, especially creative ones, but also, crucially, making the space inhabitants extremely dependent on the machine – a machine they have made and must also maintain. As the German philosopher Peter Sloterdijk would say, emancipation and attachment are a single story: 'the cosmonaut is emancipated from gravity because he or she never lives one fraction of a second outside of his or her life supports'. The ultimate opposite to 'naked' inhabitation.

- Due to its negative effects on health, astronauts usually stay only a few months, though the longest stay in space was 438 days, by Russian cosmonaut Valeri Polyakov.

Confession and Conclusion

I feel you are getting suspicious of the genuineness of my research journey and wondering where I'm going next, perhaps expecting me to head to Lagrangian

points* or even to the middle of the earth.** I don't blame you. I thank you for your patience in partaking in such a long expedition towards the understanding of lightness. For this, I want to give you my confession about the very nature of this story. The truth

is, this whole journey never took place and nor did I go through these experiences. All of this script is fictional. Well, in fact, quasi-fictional because the experiences, technologies and theoretical references are genuine and combined from various ethnographic and empirical sources such as diaries, online forums and my own conversations with people who have physically encountered some of these levitating technologies. The reason I fictionalised it was to make you, the reader, encounter such a vast range of levitating experiences in a single and coherent journey and, by creating an empathetic link with my voice, to make the encounter as close and as realistic as possible. It is sort of a writing vehicle or, better put, a type of written scenography which has facilitated narration and also the research of the phenomenology of levitation.

To summarise and conclude the experiential reality of levitation that has just taken place in various forms, modes and places, I shall mention a few phenomena that have been recurring. Lightness does not come naturally, it should be attained, earned and stabilised (as it is usually unstable) through the deliberate coupling of bodily, technological and psychological techniques. Changed states of bodily motility, orientation and life-critical processes such

- Lagrange points are locations in space where gravitational forces and the orbital motion of a body balance each other. For example, at Lagrange points L-4 and L-5, two places between Earth and moon, Earth's gravity and the moon's gravity are counterbalanced so that an object placed there would not be pulled toward either Earth or moon. The orbit would be stable and require no external means of stabilisation such as propulsion.

- ** The net gravitational force due to a spherically symmetrical planet is zero at the center. This is clear because of symmetry and also from Newton's shell theorem which states that the net gravitational force due to a spherically symmetric shell, e.g., a hollow ball, is zero anywhere inside the hollow space. Thus the material at the center is weightless.

as eating or sleeping – all have to be re-adapted and reorganised in order to negotiate a gravity-altered environment. And this is not light at all. This kind of lightness is more like a graceful reconciliation with the burdensomeness of one's own weighty body and its inseparability from gravity. Let's call it a *choreographic lightness*. The lightness of a bird, not a feather. •

As a matter of fact, there is a kind of lightness which requires little to none of these efforts. It is the state of feeling free of any sensory stimulation or the absence of awareness of one's own body, although it is extremely temporary and not open for full kin-aesthetic investigation. It is closely related to an out-of-body experience, in which one experiences the world from a location outside of one's physical body. I have experienced a few episodes of such lightness in the flesh hook suspension, sensory deprivation tank and orbiting. Let's call it a *mental lightness*.

• I am rephrasing the French poet Paul Valéry who once wrote: 'Il faut être léger comme l'oiseau, et non comme la plume' (translated as 'one should be light like a bird, and not like a feather').¹⁶

The truth is that any type of levitation and experience of lightness is constrained by limited time or restricted space. And as a rule, the longer or more spacious the levitation, the more technological backup and thus bodily stabilisation is required. It is as if the weight that was removed does not disappear and pops up elsewhere in some other form. If you want to achieve great lightness, be prepared for the equal and opposite weight of great effort and preparation.

Notes

1. Ihde, D. (1990). *Technology and the Lifeworld: From Garden to Earth*. Bloomington: Indiana University Press. pp. 82-94.
2. BME Encyclopedia (2010). *Suspension*. [online] Available at: <http://wiki.bmezine.com/index.php/Suspension> [Accessed 23 November 2010].

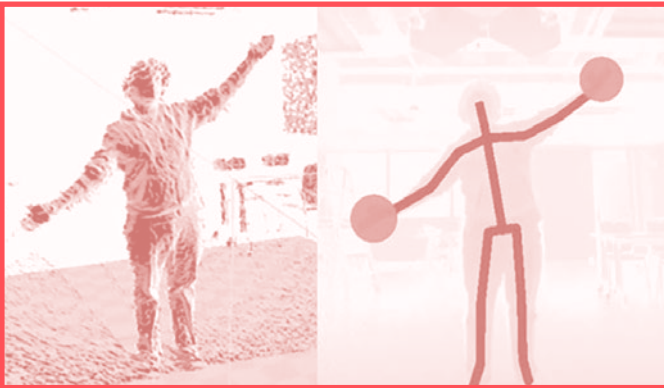
3. Irwin, H.J. (1985). *Flight of Mind: A Psychological Study of the Out-of-Body Experience*. Maryland: Scarecrow Press. p. 149.
4. Stelarc (2001). *Suspended Bodies: Uncertain, Anxious and Obsolete*. In Kostic, A. (ed.) *I Levitate, What's Next...* Maribor, Slovenia: Kibla, p. 166.
5. Flootation Tanks (n.d.). [online] *History of the Flotation Tank*. Available at: http://www.flotation-tanks.co.uk/history_of_the_flotation_tank.html [Accessed 25 October 2009].
6. O'Neill, S. (2010). Maxed out: How Long Could you Hold your Breath?. [online] *New Scientist*, 25 April. Available at: <http://www.newscientist.com/article/mg20627562.600-maxed-out-how-long-could-you-hold-your-breath.html> [Accessed 12 May 2010]. 10 gün 10 gece (2010). [online] *10 Days and Nights Under the Water*. Available at: <http://www.10gun10gece.com/en/hakkimda.html> [Accessed 12 May 2010].
7. Elert, G. (2007). Speed of a Skydiver (Terminal Velocity). [online] *The Physics Factbook*. Available at: <http://hypertextbook.com/facts/JianHuang.shtml> [Accessed 12 May 2010].
8. Auster, P. (2006). *Mr Vertigo*. London: Faber and Faber. p. 58.
9. Dubois, K. (1994). Dance and Weightlessness: Dancers, Training and Adaptation Problems in Microgravity. *Leonardo*, 27(1), p. 59.
10. Karash, Y. (2000). Russia Selling Underwater Cosmonaut Lessons. [online] *SPACE.com*, 27 May. Available at: http://www.space.com/news/spaceagencies/commercial_cosmo_000527.html [Accessed 7 November 2010].
11. Independent Print Limited (2010). Interview with Burt Rutan. [podcast]. *Big Think Podcast*. Available at: <http://bigthink.com/ideas/18881> [Accessed 8 March 2010].
12. European Space Agency (2004). *Human Spaceflight and Exploration: Learning to Live with the Laws of Motion*. [online] Available

- at: http://www.esa.int/esaHS/ESABYUOVMOC_astronauts_0.html [Accessed 11 March 2010].
13. Kerrod, R. (1989). *Illustrated History of Man in Space*. New York: Bdd Promotional Book Co, p. 13.
 14. Oberg, J.E. & Oberg, A.R. (1986). *Pioneering Space: Living on the Next Frontier*. New York: McGraw-Hill, p. 86.
 15. Quoted in: Latour, B. (2008). A Cautious Prometheus? A Few Steps Toward a Philosophy of Design (with Special Attention to Peter Sloterdijk). *Networks of Design: Proceedings of the 2008 Annual International Conference of the Design History Society*. Falmouth: University College Falmouth, p. 8.
 16. Quoted in Calvino, I. (1993). *Six Memos for the Next Millennium*. New York: Vintage Books, p. 16.

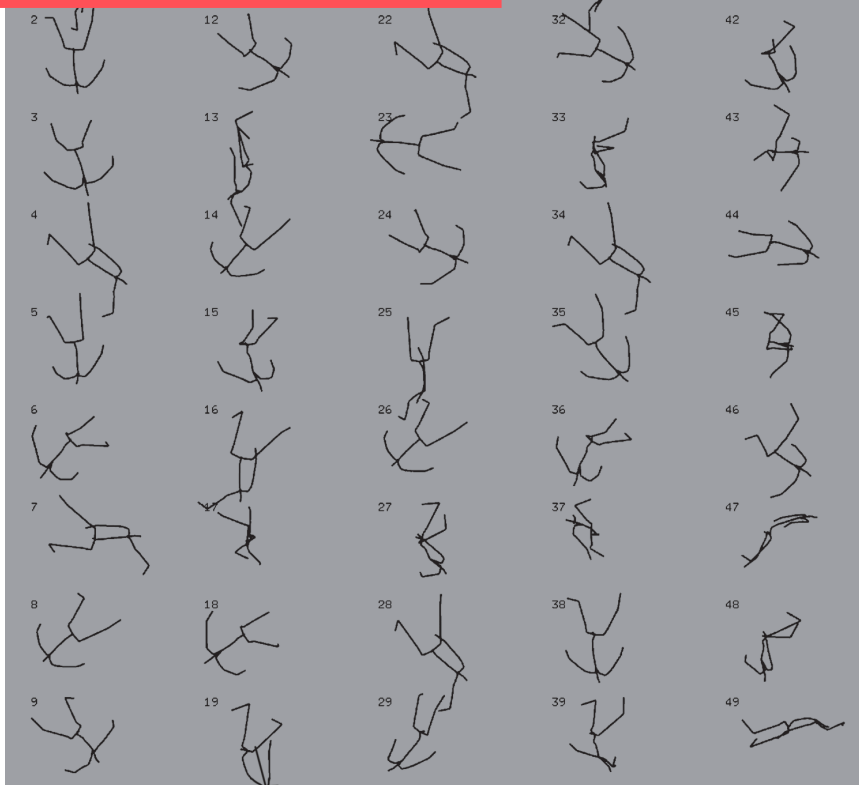
PLANET OF PEOPLE

JULIJONAS
URBONAS
AND STUDIO
POINTER*

SPECULATIVE
DIALOGUE



A: What position are you planning to choose for floating in space? Standing, lying down, perhaps stretching your arms up into the air or maybe holding a yoga pose?



B: Well, there is neither top nor bottom, so it doesn't matter whether you will stand up or lie down, it's all the same.

F



Open Acordion

H



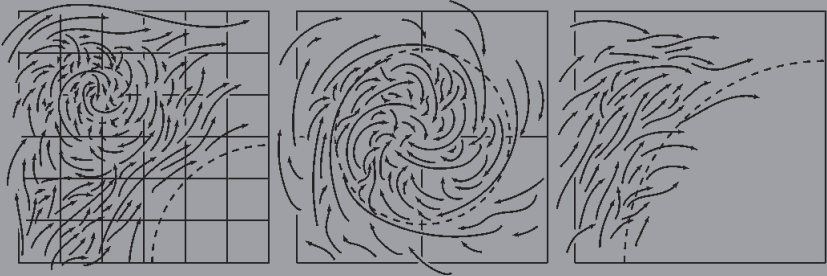
Bow

J



Donut

A: I thought your feet would point down and your head up, isn't that right?



B: Of course, having spent millions of years on the ground, it's hard for us to imagine it differently. But when there is nothing that pulls you to the ground – in fact, when there is no ground – your feet become useless! There will also be another gravitational field, or more precisely fields, radiating from our bodies themselves. That is because all objects with mass have gravitational fields. Yet this force will be so weak that it will take thousands, if not millions, of years for all of our bodies to join together.



A: I guess you are right... But I still really think I need to consider carefully what pose I should choose... Maybe I will crouch into the shape of an embryo. That way, my naked body wouldn't touch anyone else's.

B: I think you are missing the point here, my friend. Joining the bodies together is exactly what matters!



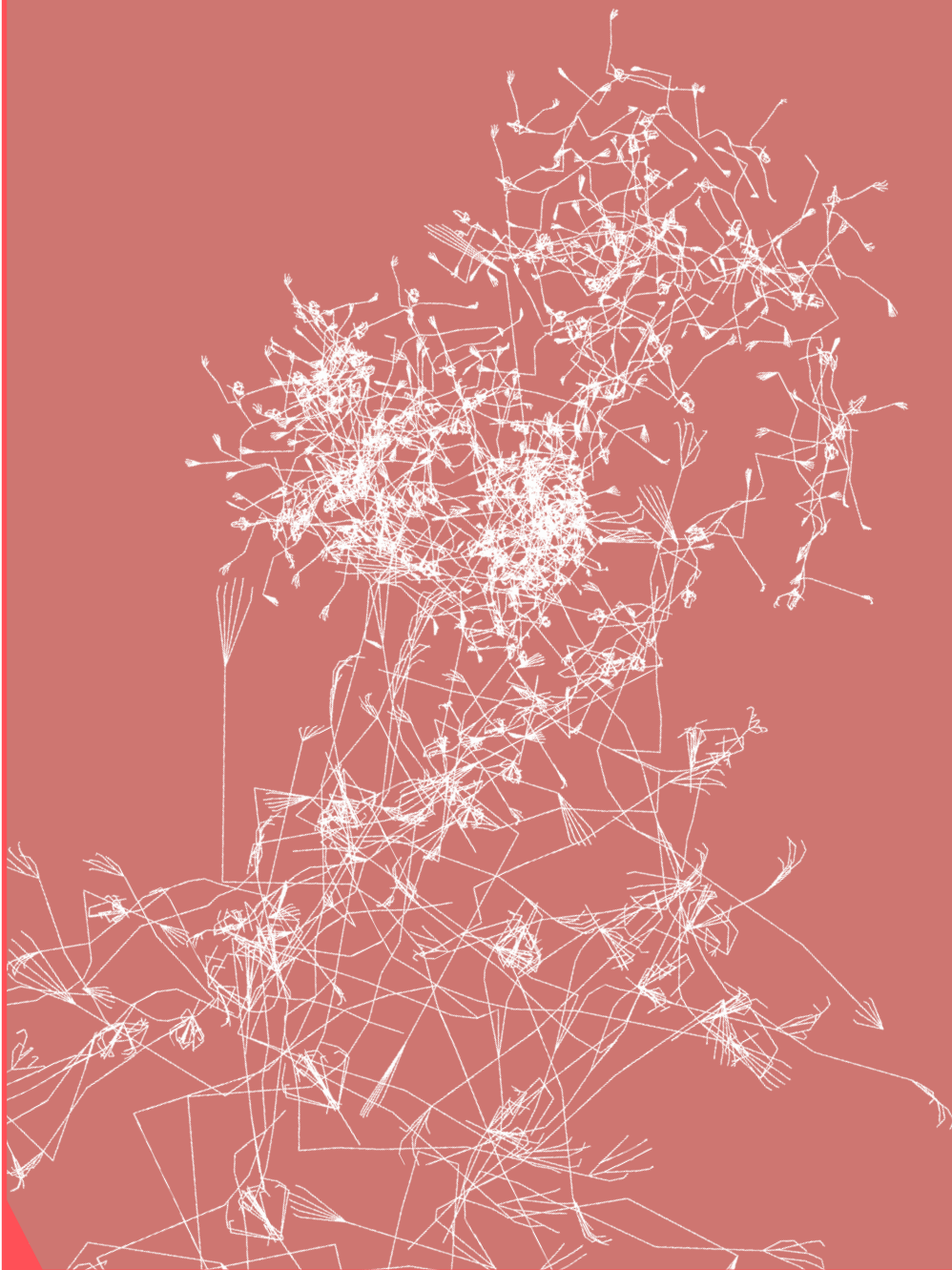
A: But the programme's initiators should have suggested that their participants take the pose of a cross. Then everyone eventually would join together with their hands and form a big circle in space. What do you think?





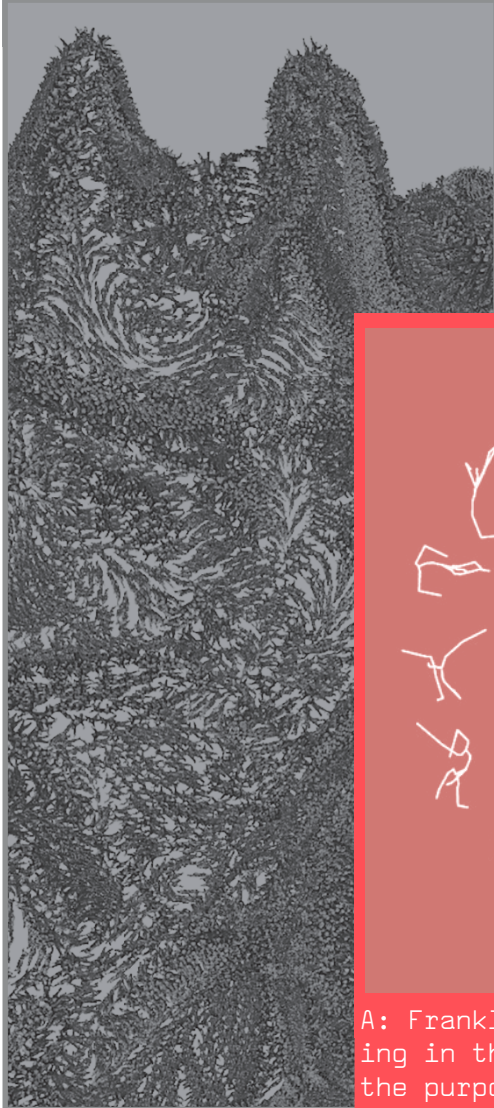
B: You see, there are all sorts of bodies – small, large, armless – and there might even be some body pieces... The idea is that you can choose how you want to float in space and keep a bit of dignity that way.





A: I'm still struggling to understand where dignity is in all this when everyone will form one big blob in space.

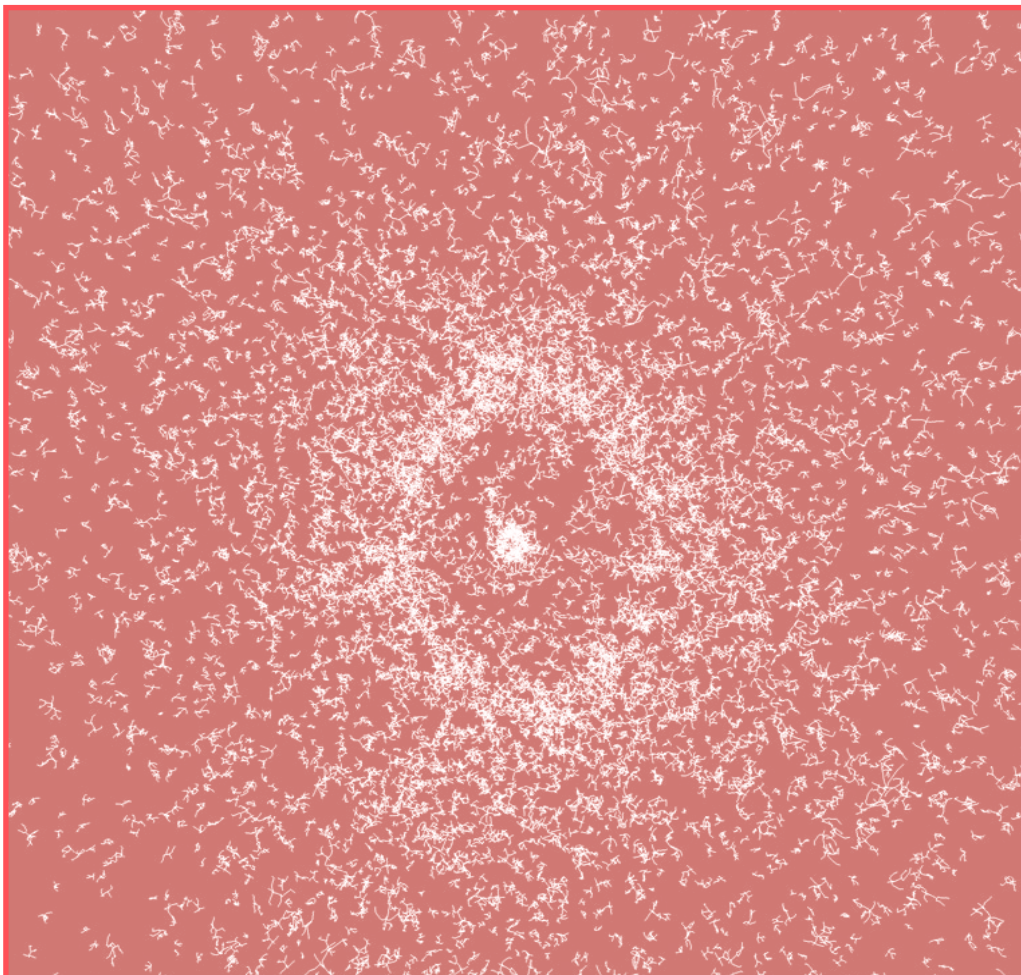
B: Let me explain to you, once all of these bodies are joined together, they will create something greater than you and all of us could individually – together we will form a new planet! Isn't that exciting?!



A: Frankly, I do not see anything exciting in this! I have trouble thinking of the purpose of these cosmic zombies if there'd be no Earth from which we could look at them.



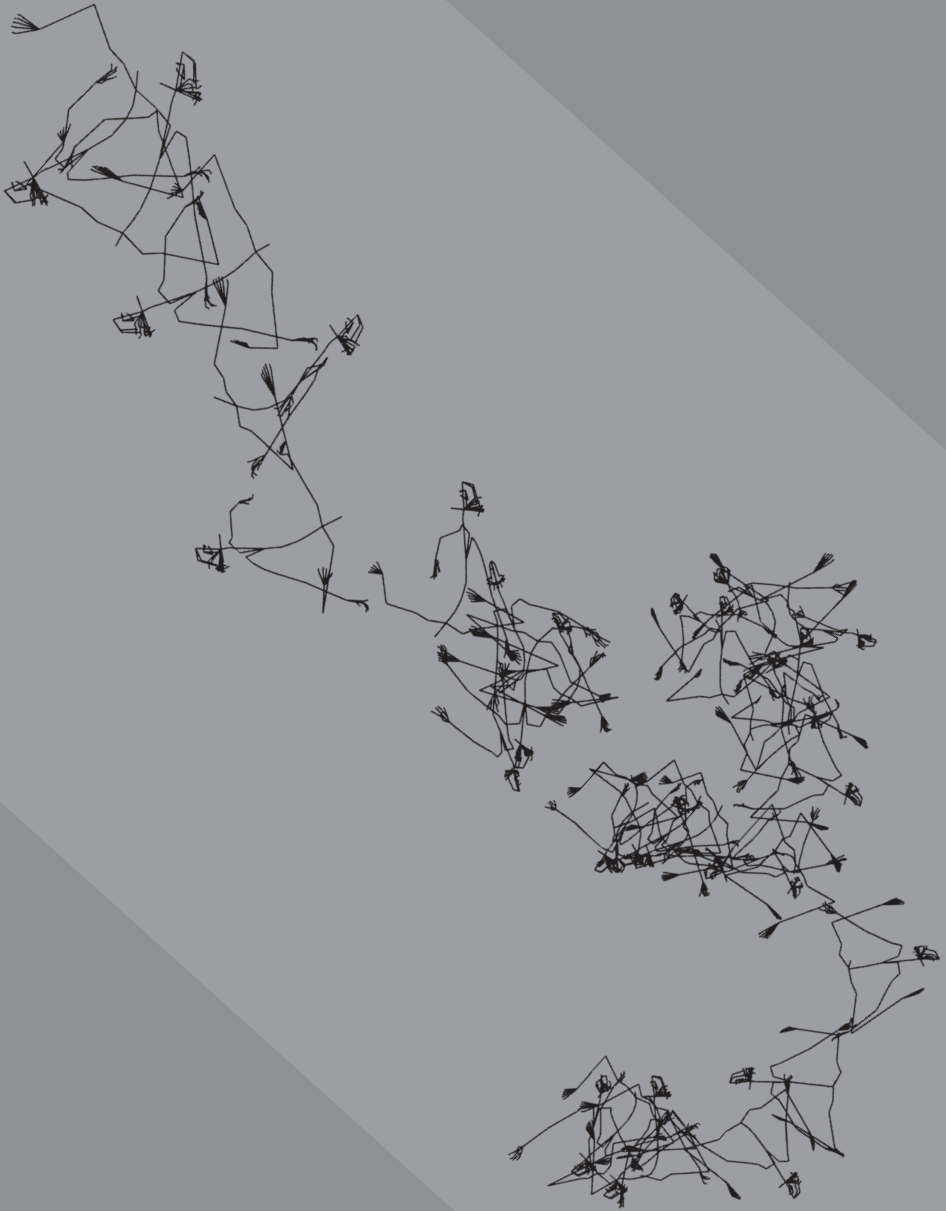
B: Well, we need to be hopeful in that respect. Also, with the help of technology, we might even be able to remain in a state of cryo-anabiosis, which means that we will be frozen with the possibility of being brought back to life. This is a chance for humanity...

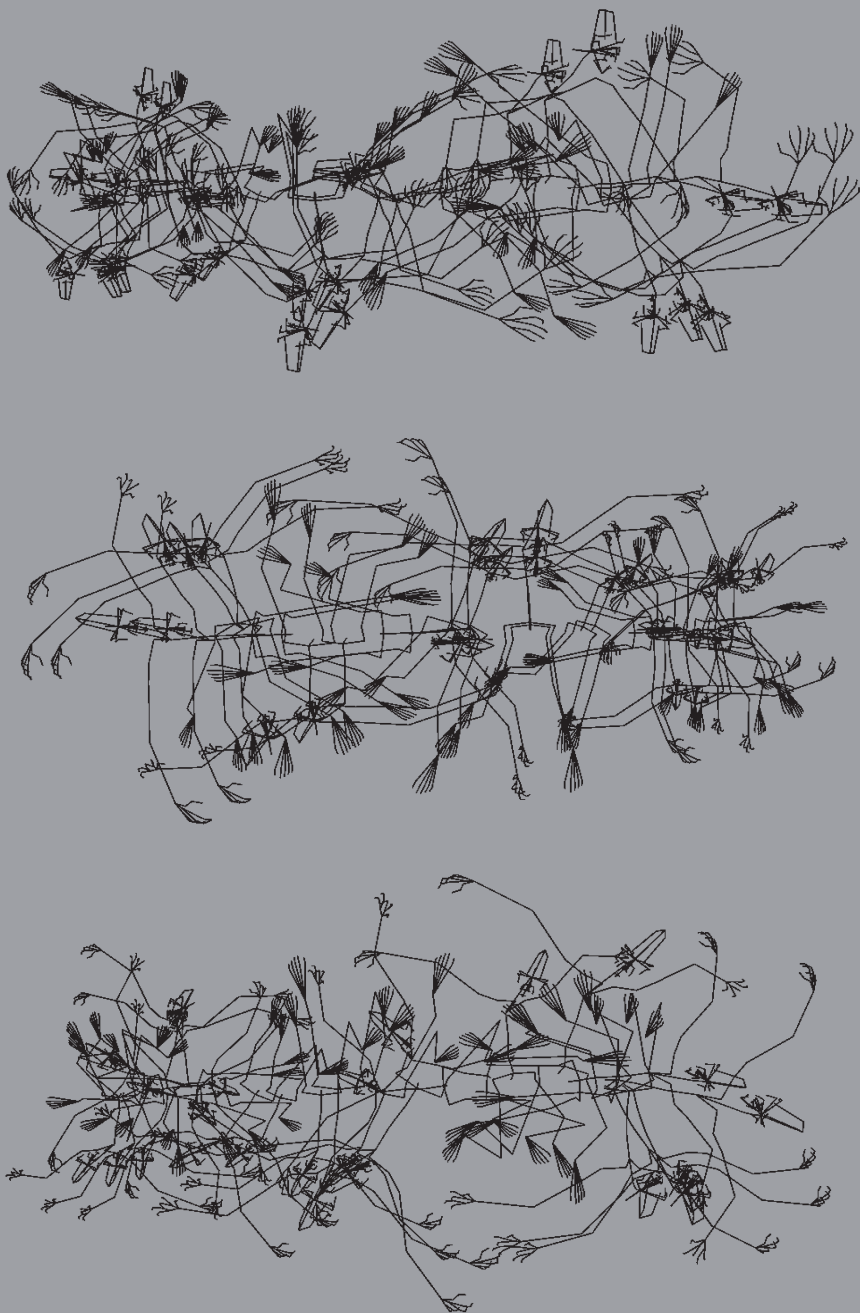


A: Right, this basically means counting on some extra-terrestrial form of life, so called aliens, that would potentially think of something like reviving us from this cold sleep in the far future. Very promising...



B: Oh! As you were saying this, another thought came to my mind! Perhaps, affected by solar radiation, this big lump of human biomass, including me and you, will mutate into some new form of life all together?





RÉGINE DEBATTY

AN ARTIFICIAL
PLANET MADE
ENTIRELY OF
HUMAN BODIES:
INTERVIEW WITH
JULIJONAS
URBONAS

Régine Debatty is a blogger, curator, art critic and founder of We Make Money Not Art. She writes and lectures internationally about the ways artists, hackers and designers use science and technology as a medium for critical discussion.

Instead of sending humans on a long and probably very painful mission to colonise Mars, how about sending human corpses to outer space to aggregate and form a new planet?

This is precisely the proposal of artist, designer, researcher, engineer, founder of the Lithuanian Space Agency (LSA) and former director of a Soviet amusement park, Julijonas Urbonas. *Planet of People* would be created by sending human bodies to the L2 point of the Earth-Sun system, one of the Lagrangian points in space. There, the frozen bodies would float around until their weak gravities make them assemble into a huge celestial body: ‘in this way, a new “human” planet is extraterrestrially formed. A cosmic fossil of humanity. A monument to humans of humans’.

What would this biomass look like? What biochemical processes would this planet undergo and would it form its own ecosystem eventually? And what would be the aesthetic, scientific, ethical, cultural and political implications, both here on Earth and out there in making this planet?

Planet of People might be speculative but it is deeply anchored in science. It draws on disciplines such as biomechanics, space law, space medicine, astrophysics, astrogeology and particularly architecture and choreography to reflect on the establishment of exo-disciplinary arts. In addition, the work invites us to question our traditional definitions of the human species and of life in general.

The results of Urbonas’s artistic research into the scientific feasibility of this artificial planet are brought together in an exhibition that allows visitors to get their body scanned in 3D and transposed into a 3D-astrophysics simulation. Their bodies then fly off into space and join those

of the previous visitors, slowly adding to the planetary mass.

I'm still wondering how we would understand this planet made of human corpses: would we use it as a glorified resting place for the ultra-rich? Would we regard it as a monument that celebrates humanity's sense of adventure? Would it become the ultimate relic of our presence in the universe after we've made the earth so toxic that our whole species disappears? Or will it just be yet another piece of space trash? I asked Urbonas to tell us more about his intriguing project:

Hi Julijonas! First, I'd like to ask you about *Cosmic Lithuanias*, the initial working title of *Planet of People*, a project in which you reflect on the cosmic identity of a Lithuanian. Unfortunately, I've never been to Lithuania and I don't know anything about the cosmic identity of the country (nor do I know anything about the cosmic identity of my own country for that matter). What makes this cosmic identity worth investigating?

The cosmic history of Lithuania spans over four centuries and involves such things as Kazimieras Simonavičius's idea for multi-stage rockets in 1650 (the first time in history this sort of idea was recorded); the establishment of one of the oldest astronomical observatories in Europe in 1753; the first successful attempt to grow plants 'from seed to seed' in space; the establishment of the Lithuanian Aerospace Association in 2009 and Lithuanian Space Agency in 2019; and, most recently, the launch of several Lithuanian nanosatellites. In the case of the latter, the nanosatellites transmitted audio recordings of messages in Lithuanian back to Earth. The messages included 'Lithuania loves freedom' and a voice recording of Lithuania's former President, Dalia Grybauskaitė saying 'Greetings to all Lithuanians around the world!'

Actually, it is these Lithuanian satellites that provoked my concern about our national space

culture, which is monopolised by technologists and businessmen. What's the value of such celestial messages addressed to a super tiny, narrow and rather techy community? I wonder how many of them spoke Lithuanian and even if they did, what have they learned from hearing such a truism as 'Lithuania loves freedom'? Ultimately, how does this achievement differ from Sputnik 1, the world's very first artificial satellite that broadcasted nothing but beeps?

Despite the prevalence of nerdy ideas, our cultural discourses have not produced any critical responses to the idea of a national space culture. It is as though our culture terminated at the Kármán line, an arbitrary designation that lies at an altitude of 100 km above Earth's sea level and commonly represents the boundary between Earth's atmosphere and outer space. I set out to do something about it and push Lithuanian culture over that line. Out of this, a dozen ideas were materialised in the forms of an opera, an extraterrestrial vodka (it's under development in collaboration with an astrobotanist Danguolė Švegždienė), a funding application for a Lithuanian Kosmica festival, as well as lectures, workshops and texts about cosmic imagination and exo-disciplinary arts. One idea has been extremely persistent, constantly recurring in my sketches, daydreams and discussions with scientists: I call it *Planet of People*, an artificial planet made entirely of human bodies. I thought it was a very promising start for a discussion about our own cosmic programme. What could be more straightforward than reducing the nation to a collection of its citizen's bodies and flying them into outer space? The nation-in-space is a cosmic nation. Its provocative tone, simplicity and, most importantly, its uniqueness compared to other space programmes made it viral. While still at the very early stage of conceptualisation, the idea was selected as one of the most important Lithuanian visions in the book, *Imagining Lithuania: 100 years, 100 visions, 1918 – 2018*.

The work combines 'astroanthropology, speculative engineering, biomechanics, space law, space medicine,

astrophysics, astrogeology and space arts'. You worked with astrophysicist Vidas Dobrovolskas for this project and you were also an artist in residency at CERN, so I suspect that the project has got some serious scientific backing. I'm intrigued by the 'speculative engineering' side of the work. How much speculation is necessary to engineer this monument to humanity made up of human corpses?

The engineering in this project is speculative in several ways. First, there are little to no engineering methods or knowledge to deal with such an idea. Terraforming, or planetary engineering in general, is still at the stage of sci-fi. Also, no mammal bodies, let alone human bodies, have ever been used as material for architectural structures, with some vaguely related exceptions such as choreographic formation practices (skydiving, human towers, etc.), military biomechanics research and the perverse assemblages of serial killers, such as Ed Gein's designs made with human flesh. Second, the idea is quite unrealistic logistically. In order to meet the definition of a planet, an unimaginably large number of bodies would be required. If we started sending ourselves out into space today, with the current worldwide birth rate we'd need around one trillion years to form a planet massive enough to become round by virtue of its own gravity. Third, the idea has unacceptable cultural implications. Hence, we have here a speculative social engineering assignment. And, ultimately, the project might be seen as a kind of bio sci-fi, for which specific quasi-fictitious engineering should be used to make things work not in reality but in the public imagination. Thus, it is more akin to what Disney calls 'imagineering'.

In my practice, I usually come up with ideas for projects by imagining a certain number of human bodies under unprecedented gravitational circumstances. A few examples: a falling trajectory that pleases and kills, a spin that enhances orgasms, a rocking motion that directs gravitational dreams, etc. In *Planet of People*, I imagine a large group of people in a state of weightlessness. I soon realised

that it is impossible to remove gravity completely, not only because we are gravitational beings (gravity has been an extremely crucial factor in our evolution), but also because we are objects with mass, hence, according to the laws of physics, also with gravity. After suspending bodies in space for a substantial amount of time, their weak gravitational forces would pull each body toward the other until a cluster was assembled. This ego-centric gravity becomes the driving force of the project.

This is exactly what would happen if we found ourselves in certain locations in outer space. These could be the Lagrange points that are located between two celestial bodies orbiting around one another (for example, the Sun and the Moon, or the Sun and Earth), in which the gravitational pull from each body compensates the other, such that a third body, for example, a space probe, can stay fixed in that point. Imagine a million, a billion or even a number with nineteen zeros (which is the minimum number of bodies required for the formation of a new planet) of frozen human bodies floating around one of the Lagrange points and forming a new celestial body.

Here we're entering the domain of speculative science and engineering. What spatial structures could we make and what movements could we choreograph?

So far, the project has been mostly based on astrophysics. One of the major elements of the project is an interactive installation that features a 3D human body scanner. The visitors are scanned and rendered in a 3D astrophysical simulation. The system assigns an individual gravitational field to each body scan and speeds up the interactions between all of them so that their 'extra-terrestrial dance' would be visible instantly. This is where the project involves some real engineering, yet its purpose is rather the imaginary workings of the space programme, in which the participants are both its protagonists and its very content. The interactive installation forces the public to confuse a human being for a planet, while also encouraging them to empathise with humans freed

from the earthly context and to think, perhaps, in an anti-terracentric way.

In the scanner, everybody can become their own planetary engineer by considering their posture and its influence on the formation of the inter-corporeal structure. This is meant to provoke our choreographic imagination (or what we can also call our proprioception or kinaesthetic/motoric imagination). However, after the first exhibition of the project in 'Life at the Edges' at the Science Gallery Dublin (2018) I realised that very few people were aware of this kind of imagination and the visitors were mostly reluctant to explore a range of body shapes. The culprit might be our contemporary preoccupation with visualism and the term 'imagination' already speaks for itself. In fact, we should remember that imagination is not only associated with the domain of the eyes but also with all our other senses. This realisation made me take a deeper look into the creative means to facilitate a choreo-imagination. I turned my attention to various

rope-and-harness suspension systems used for special effects in cinema and I consulted a specially instructed choreographer-cum-installation-operator, to give two examples. Most of these early ideas, however, ended up feeling too cumbersome or didactic, so I settled down on scenography and animation. For the latest iterations of the project, we designed an immersive atmosphere and hid the cables, devices and machinery – everything that would reveal the working mechanisms of the installation and remind the participants of their own present times. To get the choreographic imagination really going, in the project's next stage, we are going to use an automatic skeleton recognition

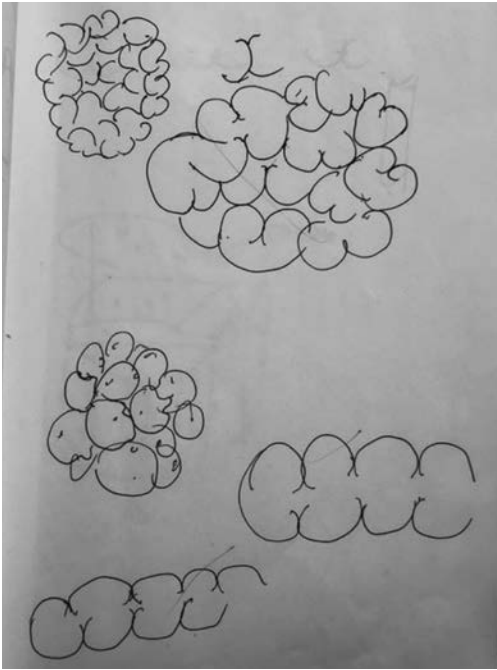


system that would rig and animate the virtual bodies. The system will constantly change their postures through randomised choreography and changing contact points. The body owners will be able to dance extra-terrestrially without actually moving themselves. Have you ever tried huddling up with other bodies in an armpit-heel-chin-chin-forefinger configuration?

There's something quite disturbing and outrageous about *Planet of People*. I suspect it is because it's difficult not to think about whether or not people would like to end up being part of this monument or whether they would like their loved ones to end up there. How do people react to the project? Do they feel, like I did for example, that a person would not be completely dead if their body were to remain intact and float out there?

People indeed do feel provoked, but I've met only a few people who've been genuinely disturbed by the idea. It looks like you're one of these very few. Perhaps, the reason for the general acceptance of this idea lies in our current obsession with apocalyptic ideas and eschatological thinking. In times where extinction is a matter not of speculative fiction but of daily journalism, the tolerance level of ecological 'graphic language' is pushing itself to the extremes; what used to be 'disturbing' is now considered 'mundane'.

It is only when the exhibition-goers immerse themselves into the narrative and process that they feel shaken up. Should I be naked? What posture makes fewest contact points with other bodies? What can my body do out there that it cannot do here? What's the ultimate posture that would define my cosmic identity? These are all concerns people have about their own individual selves and so it seems that, at first, what most people find difficult is to think of themselves as planetary beings. However, after playing around with various postures, they soon realise that such seemingly fundamental spatial definitions as 'up' and 'down', or 'vertical' and 'horizontal' no longer make sense. What does an upright posture mean



when the legs lose their footing? Heads and butts become equal. Eventually, they are forced to suspend their understanding of their body as a thing that senses, perceives, thinks and socialises. Once the body crosses the Kármán line, it gets stripped of all of its earthly definitions. The body becomes what it actually is: a nameless, thoughtless, genderless, raceless and cultureless entity. The body opens itself up for a new construct(ion).

Once you add a prefix 'astro-' to the terrestrial disciplines such as anthropology, biology or geology, you

might find the idea of the 'human planet' not as alien as it might seem. For example, from the perspective of astro-material science, everything in the Universe is formed from the same stuff, namely, baryonic matter. A Martian rock, a coconut, a polished car rim and a human body are not so different from each other. Depending on how much one wants to stretch the concept of life, one may also label any of these entities as living beings. We might suddenly start considering ourselves as planets and seeing planets as living beings (just think of the twentieth-century desert explorer Ralph Bagnold who thought of sand dunes as biological entities and became a key reference for astrobiology).

In addition to the 3D scanner, in your solo show, 'Planet of People' (Vartai Gallery, Vilnius, 2018), you also featured the *Hypergravitational Piano*. Can you speak more about this piano?

Hypergravitational Piano is a hybrid of a grand piano and a human centrifuge. The composer Gailė Gričiūtė composed a special piece that she also occasionally

played during the exhibition. It was sort of a soundtrack for *Planet of People* and a staged thought experiment for the extra-terrestrial sound piece.

Planet of People might also be considered as a thought experiment that aims to see what happens



to choreography, architecture, music and the arts in general once they cross the Kármán line. Most of these kinds of experiments have already appeared in my texts and lectures, slowly advancing towards the establishment of what I call exo-disciplinary arts. But it is just recently that these experiments started transitioning from the mental and literary domains into artistic installations. *Hypergravitational Piano*, is one such example.

I had in fact engineered this structure along with six other revolving platforms for the opera *Honey, Moon!* (2018), for which I was also both a director and a stage designer.

Together with the opera's composer Gailė Griciūtė and others, we were speculating on the genre of opera under the conditions of outer space – a sort of 'true' space opera.

When I talk about space conditions and the 'cosmic', I usually refer to altered states of gravity, such as weightlessness, artificial gravity, hypergravity, etc. *Hypergravitational Piano* uses the centrifugal force of spinning to produce artificial gravity, the force that pushes the piano player to the backrest. With each rehearsal and performance, we increased the force and observed the effects upon the player, the instrument, the sound and the music in general. Such artificial gravity produces unique gravitational fields that vary at different points of both the player and the piano. The force increases away from the spin axis and thus the fingers feel

a weaker pull than the head or the back. The movement of the playing hands and the piano strings are also affected by the complex Coriolis forces, while the constantly changing orientation of the instrument affects the way the sound is produced and distributed. This means that the composition is always changing in time while we experiment with spinning choreography. Of course, we're not working with high forces here – we are spinning the thing at moderate speeds, producing maximum $\sim 1.5 g$ (a force one and a half times higher than Earth's gravity), but during rehearsals and the performance, the composer observed that this had a unique physical and psychological effect on her creative mind, making a way for unique hypergravitational sounds and ways of listening.

You're interested in 'gravitational aesthetics' and have applied it to topics related to death (*Euthanasia Coaster* (2010) being the most famous example). Have you ever thought of applying these aesthetics to purely entertainment contexts, perhaps as a return to the Soviet amusement park of your childhood?

To be honest, I do not know what 'pure entertainment' is. If it is total distraction and infinite euphoria, I imagine it would be rather a unique kind of extreme horror without fear, cruelty and gruesomeness. Such 'entertainment' would also be the love of oppression, an adornment to the technologies that undo one's capacities to think. Neil Postman has depicted it nicely in his book *Amusing Ourselves to Death*. If this is the kind of amusement you mean, then some of my projects are already epitomising that kind of thinking. Consider *Cumspin* (2015), an orgasm-enhancing amusement ride.

Actually, I keep getting all kinds of enquiries about the feasibility and financial viability of some of my projects. I haven't done any feasibility studies and I'll leave it up to others to do this by themselves. It would take me an enormous amount of time which I would rather spend on art-making and daydreaming, and there is nothing more precious than that. It would also be super-expensive. None of the

enquirers has gone as far as planning on feasibly producing some of these projects – yet.

However, I have recently started developing a parallel line of work that is more of a down-to-earth kind of amusement. All of them are mostly public art projects. Three of them are already funded and are at the late engineering stages. One of them is a playground for children and another one is more like a hybrid of a sculpture and an amusement ride. At the moment, I can reveal details about only two of them: one is called *Escalator Slide* – a hybrid of an escalator and a slide, commissioned by a business centre in the downtown area of Vilnius. It is sort of a business-suit friendly ride, engineered to make those with expensive (cashmere or silk) suits to slide quickly but safely. I wanted to make something you could appreciate with your butt.

Another piece I am working on is *Blue Loop*, a project commissioned by the Vilnius Municipality. It is basically a loop-shaped path – part runner track, part urban-scale graphic art. Casually drawn on a bird's-eye view photo of a public square, the line circles and binds the loose elements of the space. The path crosses and penetrates all the landscape elements: the paved pedestrian zones, the green sections, the parking lot, the playground, etc. This scribble is also a sort of choreographic device with its specially shaped curves and turns of varying degrees. The workers at the business centre next to the square intend to use it as a substitute for a coffee break spot. However, the place has poor air quality, and we are currently engineering a special air quality station that would control the lighting of the path. If the path is lit green, you will be able to take a jog safely.

All images: 'A Planet of People', installation views at Gallery Vartai, Vilnius (13 December 2018 – 25 January 2019).

FEASIBILITY STUDIES

ON COSMIC TRAVELS AND BECOMING GODS: SOME REFLECTIONS ON JULIJONAS URBONAS'S *PLANET OF PEOPLE*

Lauren Reid

Lauren Reid is a PhD candidate in Social and Cultural Anthropology at the Freie Universität, Berlin where she researches how human futures beyond Earth are envisioned and planned for in Thailand today. Reid is also an independent curator, co-director of the curatorial collective 'insitu' and lecturer at the Node Centre for Curatorial Studies.

At the top of the mountain Kaokala in central Thailand, an extraterrestrial believer dreams. She finds herself falling into a familiar dream of swirling stars. Usually the stars circle before her in an expansive whirlpool. This time though, she focuses her mind's eye on just one star. By concentrating on this bright celestial body, she is propelled toward it, reaching a chalky grey surface, scarred with marks and craters caused by asteroids. Before her, an alien appears. It's an archetypal 'Grey' with a sexless, hairless body, elongated limbs and large head that swells outwards over where its brain would be, with small orifices for nose, ears and mouth and large, opaque black eyes. At the moment of her close encounter, the dreamer wakes up. She is later told by a fellow believer that she reached 'Lokukataapakadikong', a planet that humans have yet to discover and where ETs live beneath its crust.

This cosmic experience was told to me by a first-time visitor to the mountain Kaokala in central Thailand, a hub for UFO sightings and home to the headquarters of the extraterrestrial believer group UFO Kaokala. Group members train their minds based on Buddhist principles in preparation for a predicted imminent apocalypse. In doing so, they aim to communicate with extraterrestrials and transcend their attachments and ego to transcend Earth in turn. Like the dreamer, people across generations and geographies on Earth have been 'travelling' to outer space via meditation, dreaming, hypnosis, psychedelics or other altered states of consciousness. In an anecdote told by Rayna Green to M. Jane Young around 1980, the anthropologist recounts a moment

while working with Inuit communities in Alaska in which she told them about the Moon landing and astronauts walking on the Moon. Apparently, the Inuits laughed, explaining that ‘we didn’t know this was the first time you white people had been to the Moon. Our shamans have been going for years. They go all the time’.¹

Meanwhile, space scientists have been trying to overcome the limitations of the human body in the hostile environment of space. Astronauts must be protected from cosmic rays, enabled to breathe oxygen and withstand freezing temperatures, just to name a few climatic hurdles and not to mention the challenges posed by the extended length of time needed for deep space travel. Some scientific and transhumanist communities try to circumvent biological limitations in outer space by proposing that the body not travel at all. A prospective solution is ‘mind uploading’, in which one’s consciousness could be uploaded into a machine to then travel as far as mechanical technologies would allow. This idea, although based on a very Cartesian model of personhood in which the ‘mind’ can be separated from the ‘body’, is not quite as surreal as it sounds. For example, Elon Musk’s company Neuralink is developing various forms of technology that can be controlled by the mind. Scientists can already insert a chip into the brain of paralysed patients and connect it to a computer that gives the patient the ability to use the internet, read and write emails, ‘control their wheelchair, operate household appliances and manipulate mechanical arms’. Scientists can now even go further by attaching an exoskeleton to the body, which can make paralysed limbs move.²

In these ways and many others, people have projected their minds skywards to work towards surpassing the limits of Earthly physicality and mortality. Julijonas Urbonas’s *Planet of People* presents an inversion of these ideas. Instead of attempting to find a way around the limitations of the body’s abilities to travel beyond Earth, Urbonas proposes to catapult lifeless humans into space to be suspended indefinitely as a kind of future fossil. If the projection is correct that the corpses will clump together over time and generate a new planet or a celestial mass of some form, how would we as humans understand and relate to this new ‘celestial mass’?

We can first draw a parallel between these proposed-to-be-catapulted bodies and the many human-made objects that are already floating off Earth, such as derelict satellites and spent rocket stages as well as remnants from their disintegration, erosion and collisions like paint flecks, solidified liquids and other particles. The UN presently has regulations

against leaving non-functional human-made matter in space, which not only pollutes the airspace but poses deadly threats to spacecraft. Just what is defined as ‘litter’ is, however, unclear. In 2018, Elon Musk launched a Tesla Roadster into deep space, with a spacesuit-clad ‘Starman’ dummy in the driver’s seat. Its launch has been lauded by some as high art and an inspiration for new human feats in space. It has also been criticised as an egocentric publicity stunt and an unnecessary contribution to space debris. The Starman is, however, the closest thing that we presently have to a visual of a whole human body drifting loose in the cosmos.

The question of ‘litter’ is further complicated when we relate it to biological human bodies. ‘Currently, there are no specific guidelines in planetary protection policy, at either NASA or the international level, that would address the ‘burial’ of a deceased astronaut by release into space... Regarding the disposal of organic material (including bodies) on Mars, we impose no restrictions so long as all Earth microbes have been killed—so cremation would be necessary. Though planetary protection does require documentation of disposal to ensure that future missions are not surprised’, says Catherine Conley at NASA’s Office of Planetary Protection.³ Presently, nineteen people have died during space flight, however, their remains are not suspended in space as they all crashed back down to Earth along with their crafts. In compliance with Conley’s outline, cremated human remains have already been sent to space by NASA and by the private companies Celestis and Elysium Space who offer a ‘burial in space’. In these cases, small samples of cremated remains have been launched into Earth orbit, buried on the Moon or launched into outer space. For the most part, the ashes have returned to Earth to avoid contributing to space debris. Perhaps the most famous of these flights was The Founders Flight, by Celestis in 1997. Here, the cremated remains of more than twenty people travelled as a payload on the Pegasus-XL rocket, including Star Trek creator Gene Roddenberry, psychologist and psychedelic drug-advocate Timothy Leary, physicist and space visionary Gerard K. O’Neill and rocket scientist Krafft A. Ehricke.

While it’s not explicitly written in the *Planet of People* proposal, is the idea of a new celestial body close to Earth that seems to offer a potentially habitable alternative to Mars our otherwise best prospect for interplanetary living? The project takes human-engineering to the extreme by developing a planet made both by and of people. Despite Urbonas’s assertion that each body will be transformed into a ‘brick for a new structure’, there will likely be a multitude of different

ontological understandings and feelings toward *Planet of People*. Take the aforementioned practice of sending ashes into space to return to Earth as an example. Sending remains into space suggests that there is more meaning (even personhood) attached to what could otherwise be conceptualised as structural inanimate matter. Even if *Planet of People* is widely described as being formed of bricks, would we want to try to terraform and inhabit this planet the way that some hope to do on Mars? This question calls to mind the eco-dystopian film *Soylent Green*, set in the year 2022, when overpopulation, global warming and resource shortages have driven the production of a popular protein meal replacement called *Soylent Green*.⁴ In the film's iconic final scene, with mounting abject disgust and hysteria, the protagonist Thorn shouts out his discovery to the surrounding crowd that 'Soylent Green is people!' Would there be a similarly appalled reaction to building an ecosystem on and from people?

Serendipitously as I'm writing this text, my somewhat-guilty pleasure is to watch *Three Wives, One Husband*.⁵ The reality TV series follows a community of fundamentalist Mormons for one year. In the first episode, Abel Morrison—the patriarch of a family of three wives and eleven children—says, 'Our hope is that eventually we can, kind of, people our own world and become like a father and a mother in heaven to our own planet full of children'. Later, another community member, Enoch Foster, says that by growing an expansive family 'I believe we can become something more powerful, something more like God'. This fundamentalist Mormon model of *Planet of People* is obviously very different to the one proposed by Urbonas, but the conceptual parallels are hard to deny: both projects express a desire to 'play god' or become a god by creating a new world, one formed by people. There is further resonance if we borrow from the Jewish, Christian and Sufi doctrines that human beings are created in the image and likeness of God. Urbonas's proposal is perhaps emblematic of taking the godlike approach to a new extreme, where 'man' creates a new world completely of its own material.

What connects the extraterrestrial believers of UFO Kaokala in Thailand to the hopeful Mars terraformers and the fundamentalists in the Utah desert to the future mind uploaders and Julijonas Urbonas's *Planet of People* seems to be a desire for both human transcendence and immortality. All of these ideas are currently inevitably theoretical and speculative, but they are all, in their own ways, trying to preserve humankind and stretch beyond our neurobiological capabilities to expand human presence into the so-called heavens. Each approach points

toward futuristic new conceptualisations of what it means to be ‘human’—as disembodied consciousness, as God, as structural material—perhaps revealing more about how we see ourselves and our position on Earth than how we might continue in the future.

¹ Young, M. J. (1987). 'Pity the Indians of Outer Space': Native American Views of the Space Program. *Western Folklore*. 46:269-279, p.272.

² Kaku, M. (2014). *The Future of the Mind: The Scientific Quest to Understand, Enhance and Empower the Mind*. New York: Anchor Books, p. 6.

³ Stirone, S. (2017). *What Happens to Your Body When You Die in Space?*. [online] *Popular Science*, 20 January. Available at: <https://www.popsci.com/what-happens-to-your-body-when-you-die-in-space/> [Accessed 10 March 2020]

⁴ *Soylent Green* (1973). United States: Metro-Goldwyn.

⁵ Lomax, B., Warrender, J., Winston, T. (2017). *Three Wives, One Husband*. [film] United Kingdom: KEO Films (for Channel 4). Episode 1.

Li Geng

Li Geng graduated from the Department of Astronomy of Nanjing University with an undergraduate degree. Geng is an associate researcher of the National Astronomical Observatory of the Chinese Academy of Sciences and an associate professor of the School of Astronomy and Space Science of the University of Chinese Academy of Sciences. Geng's research is focused on archaeoastronomy and historical astronomy.

I would like to reflect on what it means to freeze human bodies, send them into space and form a so-called *Planet of People*. This process encourages me to think about critical meta-questions, such as, what defines a human? Being a human manifests not only through physicality but also through minds, emotions, memories and civilisations. But if we put aside these criteria for a moment, isn't a frozen human body just a bunch of macromolecules constituted of water and amino acids? Every atom in the human body comes from the universe and will return to the universe. It would be an extraordinary miracle if, in a split second, human beings would bring their developed and diverse spiritual worlds into the cold space of the universe.

As written in the ancient Chinese divination text *I Ching*: 'If the form of heaven is contemplated, the changes of time can be discovered. If the forms of men are contemplated, one can shape the world'.

EXPLORING OUTER SPACE SOCIETIES IN THE ANTHROPOCENE: *PLANET OF PEOPLE* AS A TOOL FOR INTROSPECTION

Michael Clormann

Michael Clormann, M.A., is a scientific associate and doctoral candidate at the Munich Center for Technology in Society, the Technical University of Munich. His research as a scholar in the field of Science and Technology Studies (STS) engages the sociotechnical challenges and opportunities of recent spaceflight activities in the New Space Age. He is especially interested in how awareness of space debris as a question of sustainable space environments is currently growing inside and outside the space sector. He is the co-founder of the recently established Social Studies of Outer Space research network, which brings together a global community of social scientists working on space-related topics.

Before entering academia, Clormann has worked in different capacities in and with the space sector to follow his long-standing passion for technology and its applications. After organising a public workshop titled 'Ou(te)r Space' in 2019, he is now involved in the founding and strategic development of the Technical University of Munich's new aerospace and geodesy faculty and its outreach activities.

Lagrangian point 2 (L2) is a quiet place, even for the standards of outer space. It continuously moves along with the revolution of Earth around our Sun and yet always stays shielded from the star's radiation by the 'Blue Marble' that is home to our contemporary societies. L2, named after the Italian astronomer Joseph-Louis Lagrange, is a site of equilibrium for small objects caught in the combined gravity of two much larger celestial bodies. It is located 1.5 million km from Earth and is opposite the Sun. This is approximately four times farther away from our home planet than the Moon. Every object placed at this point rests in place in relation to Earth. Everything placed there is

expected to stay where it is—undisturbed by external influences and out of sight.

Today, L2 is largely perceived as a point of scientific *extrospection*: it currently hosts several space telescopes, allowing humanity to gaze into the depths of the cosmos way beyond our own solar system. These telescopes are important to contemporary societies, as they allow us to perceive not only cosmic events far away but also to dream up utopian futures of our own culture in outer space. Such visions thrive on L2, since it provides unique conditions for space telescopes to function. As it is shielded by Earth from disruptive solar radiation, L2 is an ideal point from which to observe the wider cosmos.

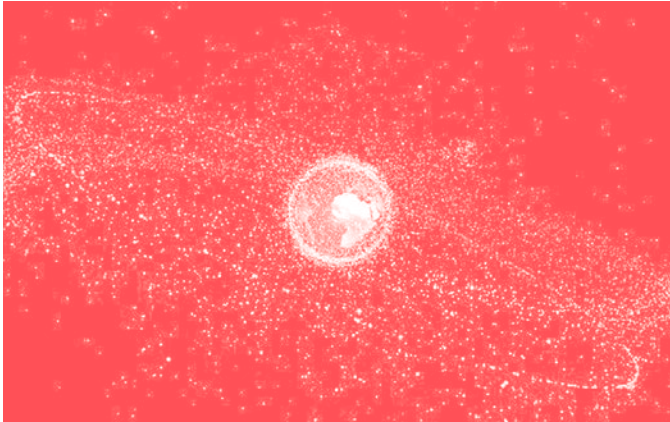
Planet of People opens up another perspective. This project provides the opportunity to also understand L2 as a point of sociotechnical *introspection*. A large assembly of human bodies dwelling there would establish L2 as an important reference point for human activities beyond our planet. While undoubtedly also being artificially created, this new planet in outer space would be quite different from a spacecraft. Purely technological artefacts can be easily embedded in narratives of human technological exploration and conquest of the cosmos; a ‘bio-artefact’ like *Planet of People* cannot. This planet would constitute a long-lasting presence of human bodies beyond Earth and so would rather require us to also turn our gaze inwards—to rethink social and sustainable life on a finite planet.

As it might encourage us to rethink outer space as a socially relevant space to make use of carefully, we will also be inclined to reflect upon living on our own planet. After all, Earth in the Anthropocene is also a planet of people in the most literal sense: inhabited and to be cared for by humans and their technologies alike.

What opportunities for *introspection* could *Planet of People* thus provide for space-faring societies?

For example, these opportunities become visible when comparing *Planet of People* to the recently growing problem of space debris. Space debris has gained widespread attention with the 2013 film, *Gravity*. Space debris usually pertains to the waste that remains in orbit as artificial satellites stop working and slowly begin to break up into smaller fragments. It is usually considered highly problematic, as it not only threatens operational satellites but also frequently re-enters Earth’s orbit and falls to the ground—putting the population at some risk. As

any orbiting object, space debris often revolves around our planet for decades, centuries or even millennia. Like space debris, the supposed *Planet of People* at L2 cannot be actively controlled and would thus remain in outer space for the unforeseeable future.



Distribution of space debris



Julijonas Urbonas, *Planet of People* , 2019

Over the past decade, space debris has been accepted as the first large-scale sustainability challenge in outer space. It reminds us that outer space is not a one-way street. Everything humanity puts up there, stays or returns at some point to haunt us. The problem arises out of potential collisions of space debris in orbit. At some point in the future, they could make spaceflight from Earth impossible. *Planet of People* could raise very similar issues: does it unnecessarily block L2 for future space missions of great importance? Does it pollute outer space? Who decides how outer space environments should be utilised? Are we

prepared to face the unforeseen cultural and material impact *Planet of People* might have on our societies in the future? Some of these questions raised do not only apply to *Planet of People* yet appear important to resolve anyway.

Another lesson to be learned in analogy to space debris recalls the politics of power in outer space. Structural inequalities can easily be reproduced beyond the planet. As space debris shows, neither the global contribution to the problem nor its negative consequences are equally distributed. While the societies of the Northern Hemisphere produce a large proportion of debris in orbit, populations near the equator face the greatest risks of being injured by falling space debris uncontrollably returning from orbit. If a celestial body of human bodies were formed, other concerns of discrimination and inequality would be raised. Which nations, communities and groups would it (not) represent and concern? Certainly, as a significant outpost of humanity in outer space, *Planet of People* would be responsible for representing globally inclusive futures in outer space. Are we ready to establish not a *Planet of People* but a *Planet of Peoples*?

As both examples point out, permanent sociotechnical activities in outer space enable societies to reflect upon themselves—to *introspect*. This is true for the use of technologies: space debris symbolises the infrastructural and social consequences of spaceflight activities and makes us think about them. This is expected to be especially true for ‘bio-artefacts’ like *Planet of People*. By employing human bodies, this project even more strongly symbolises outer space as a human habitat not too dissimilar from Earth. To question such activities in outer space always means to question what we do on Earth. Viewed as an opportunity rather than a challenge, *Planet of People* at L2 could ultimately be teaching us how to take better care of our own planet!

Xin Liu

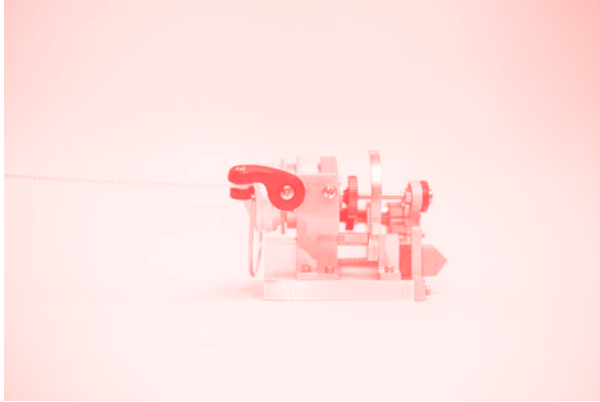
Xin Liu was born in Xinjiang, China. She is an artist and an engineer whose work ranges from performances, installations, the development of apparatus to scientific experiments and academic papers. In her practice, Xin creates experiences and artefacts to measure and modify the distance and tension between personal, social and technological spaces. Currently, Xin is the Arts Curator at the Space Exploration Initiative for MIT Media Lab, a member of New INC in New Museum and a resident at Queens Museum Artist Studio programme. From autumn 2019 she was an artist-in-residence at SETI Institute. Xin is a recipient of numerous awards for her artistic practice and academic writing. She has showcased internationally, including at Ars Electronica, Boston MFA, Sundance Film Festival, The Walker Art Center, OCAT Shanghai, ISEA and Music Tech Festival Berlin. Xin has researched and worked at Microsoft Research NYC & Asia, Google ATAP, among others. Xin received her MA in Media Arts and Sciences from MIT Media Lab after her MFA from Rhode Island School of Design and BA in Measurement, Control Technology and Instrument from Tsinghua University in Beijing.



Xin Liu, *Orbit Weaver*, 2017, 90-minute discontinuous performance in zero gravity

Gravity anchors all existence on Earth. It pulls a chaotic world to one single point in every moment of life. Even though gravity is everywhere and unending, for most of the universe vast and empty space dominates, leaving us free from gravity's tether. Is the weightless state a moment of true autonomy or does the ungrounded body simply lose control?

In June 1965, NASA astronaut Ed White stepped out of his space capsule and walked in space for the first time. Out in the vastness, he was tethered to the space station, like a child attached to the mother through the umbilical cord. In this weightless state, the body becomes dissociated from earthly conditions. If we take a glance at the universe, we inevitably question the possibilities of us being there and seek alternatives to our existence on the planet. It is time to expect an interplanetary body, a body free from the grasps of gravity.



Xin Liu, *Orbit Weaver*, 2017

Inspired by the three-dimensional mobility of arachnids, *Orbit Weaver* was made using a hand-held device so the person wearing it can regain control of her body and move freely through a weightless space. The device shoots a string out with a magnet on the tip. Once the magnet is attached to the surrounding surfaces, the device rewinds and drags the wearer with minimal impetus due to the zero-gravity environment. With the apparatus, the wearer is transformed into a 'spider woman', weaving her web in space.

The first performance of *Orbit Weaver* was on the 17th of November 2017 in the parabolic flight operated by Zero-G Corp. During each zero-gravity period (around twenty seconds), *Orbit Weaver* performed the shooting and winding of strings and dragged the performer's body forward.

ANTHROPOCOSMISM OR GRAVITY'S SATELLITES

Rebekka Ladewig

Rebekka Ladewig is a researcher in the field of Media Theory, Cultural History and Science and Technology Studies. She received her PhD from the Department of Cultural History and Theory at Humboldt-University (Berlin) in 2012 and was a research associate at the research cluster, Image Knowledge Gestaltung, an Interdisciplinary Laboratory at Humboldt University. She joined the Media Studies Department at Bauhaus University (Weimar) in 2014. She was a deputy professor of History and Theory of Cultural Techniques at Bauhaus University from 2018 to 2020 and currently works as Visiting Professor at the Media Studies Department of the University of Vienna. She is a co-founder and editor of the magazine *ilinx. Berliner Beiträge zur Kulturwissenschaft* and the book series *ilinx-Kollaborationen*, published by Spector Books (Leipzig).

Gravitation

Isaac Newton's mathematical formulation of the law of universal gravitation was the culmination point of the 17th century's 'scientific revolution' which put in place a new world view. This law of gravitation revolved around the concept of force which underlies the three laws of motion and thus all of mechanics. Force is defined as an action exerted against a body to change its state of rest or of uniform rectilinear motion. This definition of force led to the axiomatisation of mechanics. It introduced new concepts of momentum, mass and inertia, and a new explanation for the motion of celestial bodies. Henceforth, the effect of force was determined by its acceleration – a physical quantity the experimentation of which would lead to the discovery of the vestibular system in the inner ear in the last third of the 19th century.

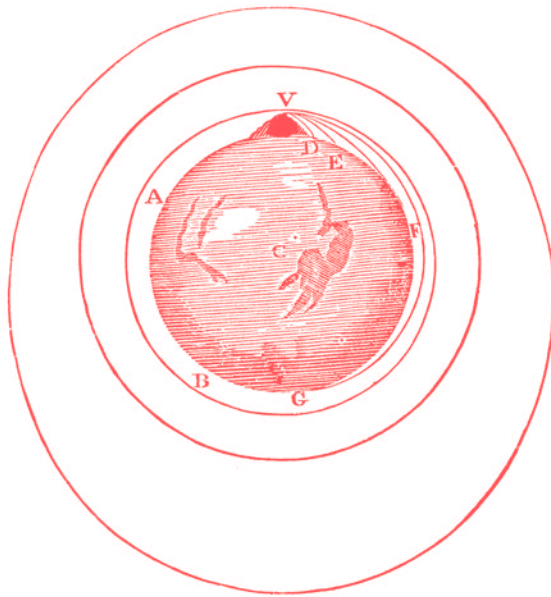
While the mathematical definition of force provided a point of departure for a new physics that originated in planetary theory, the foundation of classical mechanics is based on the three laws of motion which Newton reflects upon at the beginning of his cosmological treatise *Naturalis*

philosophiae principia mathematica (1687). The first axiom, the law of inertia, provided an important impulse for the observation of the moon's orbit. According to this axiom, a body remains in a state of rest or uniform rectilinear motion unless it is affected by an impact of an external force. In order to explain the elliptical course of the moon, Newton then linked the law of inertia to Johannes Kepler's theorem of equal areas. This allowed him to arrive at the conclusion that planetary motion is caused by centripetal forces. By combining Kepler's and Galileo's theories, Newton would eventually find the missing link which connected the motion of celestial bodies with the motion of bodies on Earth.

The theoretical possibility of overcoming the natural law of gravity in the very moment of its inception, opened up an understanding of the infinity of space and movement in space. This is demonstrated by Newton's famous thought experiment of the cannonball which velocity was high enough to allow for a parabolic trajectory to leave Earth's orbit and become gravity's first artificial satellite:

'A projectile, if it was not for the force of gravity, would not deviate towards the earth, but would go off from it in a right line, with an uniform motion, if the resistance of the air was taken away. [...] If a leaden ball, projected from the top of a mountain by force of gunpowder, with a given velocity, and in a direction parallel to the horizon, is carried in a curved line to the distance of two miles before it falls to the ground; the same, if the resistance of the air were taken away, with a double or decuple velocity, would fly twice or ten times as far. And by increasing the velocity, we may at pleasure increase the distance to which it might be projected, and diminish the curvature of the line which it might describe, till at last it should fall to the distance of 10, 30 or 90 degrees, or even might go quite round the whole earth before it falls; or lastly, so that it might never fall to the earth, but go forwards into the celestial spaces, and process in its motion *in infinitum*.'¹

The final breakthrough of the theory of gravitation as a universal law of nature, however, depended on Newton's third law of motion which equates the action of a body with the counteraction exerted on it. He suggested that action is always equal to counteraction, or that the action of two bodies on each other are always equal and of opposite direction: *actio = reactio*.



Original drawing from Isaac Newton's *Principia. The Mathematical Principles of Natural Philosophy*, Book III: *System of the World*, 1846

Anti-gravity

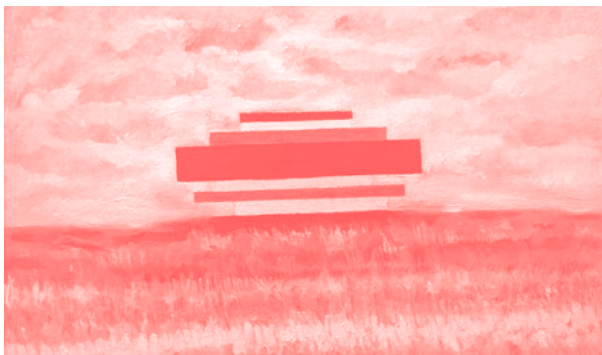
In 1903, Newton's third axiom came to be the centerpiece of the mathematical formulation of rocket propulsion, initially presented by the Russian inventor, engineer and rocket pioneer Konstantin Tsiolkovsky.² The rocket equation (sometimes named after Tsiolkovsky) describes a motion of a vehicle that applies thrust acceleration by expelling parts of its own mass with a high velocity. This process, the principle of recoil propulsion, has been outlined by the chemist and revolutionary Nikolai I. Kibalchich shortly before his execution in 1881. Having played a decisive role in the assassination attempt on Alexander II by supplying explosive material and subsequently being sentenced to death, Kibalchich had no time to further develop his idea or to prove it. As the tale goes, the revolutionary, imprisoned and awaiting his imminent execution, continued to work on the design of a 'platform' which would launch into the sky by recoil, using the same dynamite that the conspirators had used in Alexander's assassination attempt.

Like Kibalchich, Tsiolkovsky firmly believed in the technical possibility of recoil-driven apparatuses. His vision, like Kibalchich's before

him, took shape in the period of revolutionary upheavals and it was intimately linked to the dream of overcoming gravity and advancing into weightless space. As Tsiolkovsky noted in hindsight, '[my] favorite dream consisted of a confused idea of a world without gravity, a world in which one could move freely in all directions in the air. In what way these desires arose in me, I cannot understand to this day; [...] but obscurely I believed, felt and wished for just a world without gravity'.³

The idea of weightlessness fueled the Russian avant-garde movement, leaving an impact on artists, engineers and scientists alike. One of the lesser known and rather late manifestations of the artistic obsession with weightlessness can be found in the painting *Suprematist Landscape (Cosmic Device)* by Konstantin Rozhdestvensky, a student and admirer of Kazimir Malevich. While by the end of the 1920s Malevich returned to figurative painting (of mainly peasant motifs), Rozhdestvensky's painting from 1935 not only paid tribute to the sublime period of Suprematism and Malevich's invention of *planits*,⁴ but also to Kibalchich's revolutionary platform.

A perfectly geometric cuboid floats on the backdrop of an impressionistic landscape of stormy clouds that nestle around the clear form of the alien object which may launch into space momentarily. The contrast between expressive brushstrokes and geometric purity is striking. We know from Rozhdestvensky's memoir that these opposites may well have been intended: 'Paul Cézanne, strove to represent the gravity of the material world surrounding us in his painting. Suprematism is weightlessness, is the tension of the dynamic energy of the cosmic space where a different reality prevails, a reality that knows neither top nor bottom, neither weight nor gravity.'⁵



Konstantin Rozhdestvensky, *Suprematist Landscape (Cosmic Device)*, 1935, oil on canvas, 31.9 x 26.4 cm

Merging with the movement of cosmism and bio-cosmism respectively, the idea of weightless infinity, so delicately contained in Newton's metaphysical notion of absolute space, took on a socio-utopian form. Outer space was imagined as a future habitat for humans to colonise and overcome all material limits and restraints of life on Earth (including mortality).⁶ Tsiolkovsky himself was among the first to describe what has since become a ubiquitous commonplace in science fiction. According to his idea of cosmo-evolutionary development, cosmic society would set out to extend its habitats from rockets and spaceships to orbital satellites that fully adapt to life in space:

'In order to obtain oxygen and food and to clean the air in the rocket one conceives of extra space for plants. All of this is shipped to space by rockets in a folded state and then assembled. Man becomes largely independent of the earth and develops the means to support life in space. Spacious settlements are established around the earth. Solar energy is exploited not only for food, but also for transportation in the solar system. Colonies are established in the asteroid belt and other places in the solar system where only smaller celestial bodies are found.'⁷

Technoscientific cosmo-colonialism

However fantastic, Tsiolkovsky's evolutionary trajectory of anthropocosmic man still resonates in the distinctly techno-scientific versions of space colonisation in the Space Age when such topics gained new momentum mainly for geopolitical reasons. The importance of the matter was thrown in sharp relief in the *Conference on Space Manufacturing* (1974), the year the mission of the Skylab space station and solar telescope was abandoned, and the *Conference on the Colonization of Space* (1975) (both were a joint venture of the American Institute of Aeronautics and Astronautics, NASA and Princeton University). Assembling speakers from a wide range of disciplines from all relevant US tech and academic institutions (including NASA, MIT, the Lockheed Missiles & Space Company, General Electrics, Stanford University, Columbia University and Princeton University), the conferences addressed topics of outer space habitation, transportation, social organisation and engineering technologies such as the development of a satellite solar power station—topics that were already outlined by Tsiolkovsky.

For instance, the architect and curator at the Museum of Modern Art, New York, Ludwig Glaeser contributed a paper on the architecture of space habitats where he discussed the processes of physiological, cognitive and environmental adaptation to 'satellite environments as

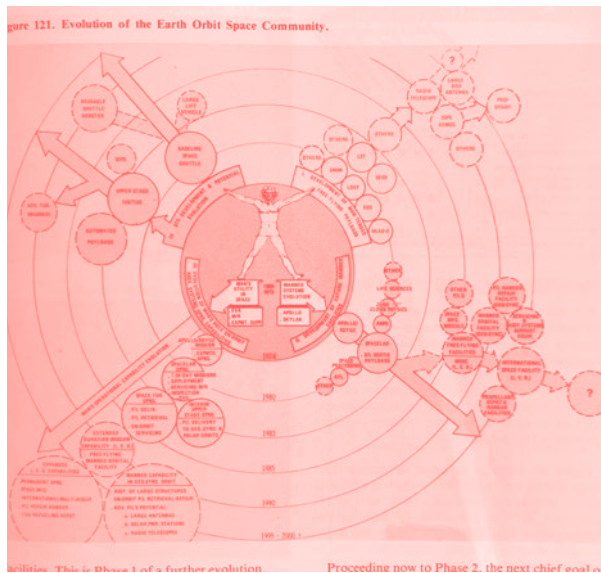
open-ended systems.’⁸ Gerald Feinberg, a professor of physics at Columbia University, has also elaborated on the ecological niche provided by space colonisation. According to Feinberg, this niche would allow for an increase in the human population—a developmental step he compared to the Neolithic invention of agriculture. His idea of an increased population that ‘can result in increased total amounts of time devoted to arts and sciences’ and ‘offer a way to deal with future extended human lifespans’ invokes the hallucinatory visions of future life design in the context of bio-cosmism.⁹

Perhaps one of the most notable contributions (one which clearly echoes the writings of Konstantin Tsiolkovsky) was presented by the German-born science fiction writer and aerospace engineer Jesco von Puttkamer.¹⁰ Puttkamer had joined NASA in the early 1960s as an engineer for the Apollo programme and later served as programme manager in charge of long-range planning of deep space manned activities.

Situating so-called *man-made worlds* in outer space in the year 2000+, he suggested four subsequent stages of space occupancy. Starting with the ‘permanent occupancy of near-Earth space’, Puttkamer envisaged the advance into Earth-Moon space and the establishment of space communities in space stations around the Lagrange point (L5).¹¹ This would be followed by the full self-sufficiency of humans in Earth-Moon space until humans would eventually reach a ‘permanent occupancy of helio-centric space’ in Mars settlements or asteroid colonies.¹²

The most important feature in Puttkamer’s paper, however, was his diagrammatic appropriation of Leonardo da Vinci’s *Vitruvian Man*, the very emblem of ideal human body proportions in perfect alignment, physically and metaphysically, with Renaissance cosmography. In Puttkamer’s diagram, in contrast, the cosmographic unity between man and his world is cracked open to a terraforming end. The human figure is still at the center, yet it is lifted onto two platforms, the left one reading ‘man’s utility in space’, the right one ‘manned systems evolution’, the techno-scientific realisation of Kibalchich’s prison dream.

The *Vitruvian Man*’s hands reach beyond the circle: they no longer serve as measures for human proportions, but connect him to the technologies of protective environments that extend into a multiplicity of man-made worlds in Outer Space. Puttkamer’s diagram iconically substitutes the *Vitruvian Man* with an anthropo-cosmic depiction of the future spaceman.¹³



Jesco von Puttkamer, *Evolution of Earth Orbit Space Community*, 1974

Meanwhile, we have come to live in a new geochronological era of our planet called the Anthropocene. It is not only the atmosphere that has essentially changed and become a technospheric environment, it is on Earth where, as of the year 2021 (plus or minus six years), the human-made mass referred to as anthropogenic mass amounts to approximately 1.1 teratonnes and will exceed all living biomass on Earth.¹⁴ Perhaps it is the right time for a new dream of weightlessness, the free floating of bodies in space?

¹ Newton, I. (1687). *Mathematical Principles of Natural Philosophy*. Translated by A. Motte [1729]. Translated and revised by F. Cajori [1962]. Berkeley, Los Angeles, London: University of California Press, p. 3.

² Ordway, F. I. (1970). History of Astronautics Symposium: Mar Del Plata, Argentina, October 1969. *Technology and Culture*, Volume 11(3), pp. 407-416.

³ Blagonrawow, A., Worobjow, B. and Sokolski, W. (eds.) (1962). *Konstantin E. Tsiolkovsky: Ausgewählte Werke*. Moscow, p. 112 [my translation].

⁴ Planits is the title for a series of constructivist architectural drawings that refers to habitats for ‘earth dwellers in space’. Kwiatkowski, J. (2015). *The Space of the Avantgarde – a New Gravitation*. [online] Journals PAS. Available at: <https://journals.pan.pl/Content/88320/mainfile.pdf>, p. 26. [Accessed 20 January 2021]

⁵ Albertina, Vienna [leaflet].

⁶ Groys, B., Hagemeister, M. and Heiden, A. von der (eds.) (2005). *Die neue Menschheit: biopolitische Utopien in Russland zu Beginn der 20. Jahrhunderts*, Frankfurt am Main: Suhrkamp; Groys, B. (ed.) (2018). *Russian Cosmism*. Cambridge, Mass., London: MIT Press.

⁷ Aleksandrovic Kosmodemjanski, A. (1979). *Konstantin Eduardowitsch Ziolkowski*. Reprint. Goetz, D.,

Wächtler, E., Winter, I. and Wußing, H. (eds.). Moscow, pp. 155f; See also, Ciolkovskij, K. (2005). *Das lebende Universum* (ca. 1918). In: Groys, B., Hagemeister, M. and Heiden, A. von der (eds.), *Die neue Menschheit: biopolitische Utopien in Russland zu Beginn der 20. Jahrhunderts*, Frankfurt am Main: Suhrkamp, pp. 309-350.

⁸ Glaeser, L. (1975). *Architectural Studies for a Space Habitat*. [online] Aero Space Central. Available at: <https://doi.org/10.2514/6.1975-2022> [Accessed 20 January 2021].

⁹ Jesco von Puttkamer, “Developing Space Occupancy: Perspectives on NASA Future Space Program Planning,” in: *Proceedings of the Princeton/AIAA/NASA Conference*, May 7-9, 1975, ed. by Jerry Grey, pp. 209-220.

⁹ Feinberg, G. (1975). *Some Social Implications of Space Colonization*. [online] Aero Space Central. Available at: <https://doi.org/10.2514/6.1975-2042> [Accessed 20 January 2021].

¹⁰ Puttkamer, J. von (1975). *Developing Space Occupancy: Perspectives on NASA Future Space Program Planning*. In: *Proceedings of the Princeton/AIAA/NASA Conference, May 7-9, 1975*. New York : American Institute of Aeronautics and Astronautics, pp. 209-220.

¹¹ Ibid., p. 212.

¹² Ibid., p. 213.

¹³ For an in-depth elaboration on this topic, see: Scott, F. (2002). Welten machen, Menschen konfigurieren, oder: Von der Welt zum Menschen zur Welt. In: Ladewig, R. and Seppi, A. (eds.). *Milieu Fragmente. Technologische und ästhetische Perspektiven*. Leipzig: Spector Books, pp. 342-353.

¹⁴ Elhacham, E., Ben-Uri, L., Grozovski, J., Bar-On, Y. M. and Milo, E. (2020). Global human-made mass exceeds all living biomass. *Nature*, (588), pp. 442-444.

‘HOW HUMANS IMAGINE THE UNIVERSE IS QUITE NARCISSISTIC’: FROM A DISCUSSION ABOUT PLANET OF PEOPLE BASED ON CURRENT TIMES

Hu Fei and Jia Liu

Hu Fei, Secretary-General, Beijing Contemporary Art Foundation. Hu Fei has worked in China's premium cultural and creative institutions such as New Weekly, Beijing Smile Angel Foundation and Metaspace. She has curated and organised cross-border cooperation projects: World film master Wim Wenders China Tour (2019), BCAF and WHO collaboration China Art Film Fund 'Short Films of Depressions'. She has participated in the charity concert held by the famous musician Faye Wong at the National Centre for the Performing Arts, China, the annual charity gala of the Smile Angel Foundation, the special exhibition of the Chinese contemporary artist Zeng Fanzhi at the Louvre in France, the NOVA Prize Exhibition at Ars Electronica Festival in Austria, Kassel Documenta and others.

Jia Liu is a NSF Postdoctoral Fellow at the Berkeley Center For Cosmological Physics, UC Berkeley. Liu's current work focuses on weak lensing non-Gaussian statistics, using N-body ray-tracing simulations as a tool to study the large-scale structure of our universe. The ultimate goal of this work is to understand the nature of dark energy, the total mass of neutrinos and other cosmological parameters.

Hu Fei: In my opinion, this work mainly revolves around the issue of space colonisation. Due to the outbreak of the COVID-19, humans have been reflecting more and more on the ecological sustainability of our planet, concurrently thinking about life in outer space—can we migrate to outer space to survive if the earth's environment continues to deteriorate? Will existing outer space experiments and large amounts of floating debris cause significant pollution to the orbiting system?

Once we start our life on other planets, will it colonise the aboriginals of this galaxy? This in turn raises a discussion on Kant's 'ethics'.

In the work of *Planet of People*, these problems can potentially be solved by forming a new planet by transferring human bodies to the L2 point to float freely. Since this planet is composed of individuals, there are no aboriginals and therefore there won't be any colonisation. As each human body is launched in more or less the same way and the fact their floating trajectories are quite similar, the project is relatively fair. All the individuals are parts of this new planet and they remain as a whole but independent from each other at the same time.

This project seems to solve these issues of colonisation and equality from a hypothetical point of view, but what I still want to explore is how would you perceive it from your own perspective and that of astronomy too?

Jia Liu: The concept of *Planet of People* is definitely invalid if you try to substantiate it with science. First, the human body cannot physically survive in outer space. If you really want to achieve this, you need to build an artificial object. This would be a bit like what you see in the film *Interstellar*, where humans build a cylindrical space station they can live in and which also generates its own energy.

Second, there are five Lagrangian points on the trajectory of Earth's movement around the Sun, which is exactly where the gravity of Earth and the Moon cancels out. They are very stable, which is also why artificial satellites, the International Space Station and space telescopes are launched to those points. You can also find some small meteorites there and those develop into an aggregate. L2 has always been a point of interest for launching technology equipment for various countries because it will not be exposed to the Sun all year round, so the energy consumption is very small, but it is not always stable and the trajectory of the launcher must be fine-tuned every year.

L2 also has a role when humans are searching for life on planets outside the solar system. Because we assume that only intelligent organisms can launch technology equipment to L2, any signs of another presence in that particular space is indicative of the existence of advanced non-human intelligence. L2 is genuinely not comfortable for human gathering, it is very cold and dark. Personally, I wouldn't want to float in such a place, it makes me quite anxious just imagining it.

Hu Fei: You know artists tend to interpret and define human behaviours in outer space from the perspectives of philosophy and ideology; is this the case for scientists too when doing research?

Jia Liu: These are both critical and essential perspectives when it comes to scientific research. Questions such as ‘where do humans come from?’ and ‘where are we going?’ are fundamental questions that fascinate and captivate us, compelling us to do research. In reality, however, human beings are not really that powerful to actually make an impact on the universe.

Hu Fei: How humans imagine the universe is quite narcissistic.

Jia Liu: Indeed. The universe itself is very neutral. It would even be hard to determine that human ‘colonisation’ of the universe is ‘good or bad’ because we haven’t gained a full understanding of the meaning of the universe; therefore, how can we define ‘good or bad’ without first trying to define ‘meaning of the universe’? In the vast universe, human behaviour is negligible. We always tend to think about the universe with Earth as its centre, but the universe does not care.

Theodore W. Hall

Theodore W. Hall was born in Michigan, USA. He earned B.S., M.Arch. and Arch.D. degrees in architecture at the University of Michigan. His professional career turned toward software development for computer-aided design, while he also maintains a long-term personal interest in space architecture, especially for artificial gravity in orbital habitats. In 1994, he accepted a post-doctoral fellowship at the Chinese University of Hong Kong (CUHK), developing software for scientific visualisation and virtual reality in architecture. He has also had small teaching and research positions at the University of Hong Kong (HKU), Deakin University in Geelong, Australia and the New Jersey Institute of Technology in Newark, USA. He returned to the University of Michigan in 2009, where he is now a virtual-reality visualisation specialist at the interdisciplinary Duderstadt Center.

He was a founding member of the Space Architecture Technical Committee (SATC) in the American Institute of Aeronautics and Astronautics (AIAA) and chaired the committee 2010-2014. He also organised and chaired the space-architecture sessions at the annual International Conference on Environmental Systems, 2007-2010 and 2013-2014.

Let's try to put some numbers on this.

A) What is the mass of a human body?

I don't know if there is any data regarding an 'average' for all genders, races, ethnicities, ages (from infant to peak-fit young adulthood), across Earth's entire population, so I will simply use my own mass: 82 kg

B) How many human bodies are currently living on Earth?

About 7,763,000,000 as of the moment I am writing this (2020-02-08).

<https://www.worldometers.info/world-population/>

C) Total mass of living human bodies:

$$82 \times 7,763,000,000 = 636,600,000,000 \text{ kg}$$

That's obviously an overestimate since I'm a North American caucasian adult male.

D) Another estimate, from

<https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-12-439>

'In 2005, the total adult human biomass was approximately 287 million tonnes', which is 287,000,000,000 kg

That's obviously an underestimate, since it's 15 years old and counts only 'adults'.

E) What is the mass of even a small 'planet'?

The smallest known dwarf planet that meets all of the criteria for a planet (including 'enough mass that its own gravity has pulled it into a spherical shape') is Hygiea:

<https://www.newscientist.com/article/2221288-surprisingly-round-asteroid-may-actually-be-the-smallest-dwarf-planet/>

Properties of Hygiea, from Wikipedia:

https://en.wikipedia.org/wiki/10_Hygiea

$$m \text{ [mass]} = 8.32 \times 10^{19} \text{ kg}$$

$$r \text{ [mean radius]} = (434 \text{ km}) / 2 = 217,000 \text{ m}$$

$$\rho \text{ [mean density]} = 1.94 \text{ g/cm}^3 = 1,940 \text{ kg/m}^3$$

$$v \text{ [volume, sphere]} = \frac{4}{3} \pi r^3 = 4.28 \times 10^{16} \text{ m}^3$$

F) How many times the entire current human mass is Hygiea?

Using the estimated human mass from (C):

$$(8.32 \times 10^{19} \text{ kg}) / (6.366 \times 10^{11} \text{ kg}) = 131,000,000$$

Using the estimated human mass from (D):

$$(8.32 \times 10^{19} \text{ kg}) / (2.87 \times 10^{11} \text{ kg}) = 290,000,000$$

So, even the smallest dwarf planet with enough self-gravity to form itself has between 131 million and 290 million times the mass of the entire current living human population.

- G) How big would be a 'planet' formed from all current living human bodies? First, let's estimate the volume.

As a very rough estimate, let us assume the density of this 'planet' is the density of a human body and about equal to the density of water: $1,000 \text{ kg/m}^3$

Using the estimated human mass from (C):

$$(6.366 \times 10^{11} \text{ kg}) / (1 \times 10^3 \text{ kg/m}^3) = 6.366 \times 10^8 \text{ m}^3$$

Using the estimated human mass from (D):

$$(2.87 \times 10^{11} \text{ kg}) / (1 \times 10^3 \text{ kg/m}^3) = 2.87 \times 10^8 \text{ m}^3$$

For a sphere:

$$V = \frac{4}{3} \pi r^3$$
$$r = \sqrt[3]{(3V)/(4\pi)}$$

Using (C): $r = 534 \text{ m}$

Using (D): $r = 409 \text{ m}$

So the diameter of a 'planet' containing the equivalent of all current living human bodies would be only about 1 km. Very tiny for a 'planet'.

- H) How many times the entire current human volume is Hygiea?

Using the estimated human volume from (G) and (C):

$$(4.28 \times 10^{16} \text{ m}^3) / (6.366 \times 10^8 \text{ m}^3) = 67,200,000$$

Using the estimated human volume from (G) and (D):

$$(4.28 \times 10^{16} \text{ m}^3) / (2.87 \times 10^8 \text{ m}^3) = 149,000,000$$

- I) Our mass ratio estimates in (F) above are between 131,000,000 and 290,000,000. Our volume ratio estimates in (H) are between 67,200,000 and 149,000,000. These are consistent with Hygiea having a density of 1.95 times the density of the body planet (which we initially estimated to be the density of water).
- J) What would be the surface gravity on a planet 534 m in radius with a mass of $6.366 \times 10^{11} \text{ kg}$ (our biggest estimate for the body planet)?

Combining Newton's Laws of motion and gravitation, the acceleration due to gravity on the surface of this planet would be:

$$\begin{aligned} a &= G m / r^2 \text{ [where } G \text{ is Newton's universal gravitational constant]} \\ &= 6.674 \times 10^{-11} \text{ m}^3 / (\text{kg} \cdot \text{s}^2) [= G] \\ &\times 6.366 \times 10^{11} \text{ kg [= } m] \\ &/ (534 \text{ m})^2 [= r^2] \\ &= 1.49 \times 10^{-4} \text{ m/s}^2 \end{aligned}$$

On Earth, the corresponding value—defined as 1 *g*—is 9.80665 m/s².

So, a human body based planet's surface gravity, even after accumulating all currently living human bodies, is only about $1.49 \times 10^{-4} / 9.80665 = 0.0000152 \text{ } g$

* * *

In conclusion, there aren't nearly enough human bodies to form a planet that will coalesce under its own gravity. We don't know that Hygiea is the smallest planet possible, but it's the smallest we've found, and it's several hundred million times as massive as the entire current supply of human bodies.

It would take some wild assumptions regarding the number of human generations, human longevity and population growth to come up with any kind of estimate of how long it will take to produce 100,000,000 times the current number of bodies, but I think it will be a very long time.

I don't know everything that happens to an unprotected human body in the space environment, considering it would have to deal with vacuum,

radiation, extreme temperature swings, micro-meteoroid bombardment. I suppose that one of the first things to occur will be the vaporisation of all the body's water, due to the hard vacuum.

'Up to 60% of the human adult body is water'.

<https://www.usgs.gov/special-topic/water-science-school/science/water-you-water-and-human-body>

That mass will jet out of any available orifice or pore. The body's self-gravity will not be sufficient to restrain it. It will be lost to space, especially in the presence of the solar wind, which is known to strip the atmosphere from much larger 'planets'. The remainder of the body will be a desiccated husk, smaller and much less massive, but perhaps denser, comprising the dry mineral contents of the body. Over time I suppose this will be reduced to dust by the other space environmental factors mentioned above: radiation, bombardment by micro-meteoroids, temperature extremes between sunlit and shaded areas and so on.

Over aeons of time (the time it will take to replicate the human population 100,000,000 times), this dust might be attracted to other celestial bodies with a bigger head-start on planetary accretion.

Alternatively, the bodies might be cryogenically frozen and sent in protective insulated caskets to deep space beyond the asteroid belt where icy bodies can endure the Sun's distant glow. The bodies might retain their mass of water ice. The question then would be: how to separate the caskets from the bodies so as not to contaminate the purity of the body planet? The mass of caskets would exceed the mass of bodies and would be relatively more likely to coalesce into a casket planet (but still unlikely to do so anytime soon).

* * *

I have not even begun to consider the mass of launch vehicles and propellant required to deliver that many human bodies (and caskets) to deep space—Jupiter, Saturn and beyond. Launch vehicles are not huge just because rocket scientists love huge rockets. In fact, they are the smallest, least massive vehicles that engineers can devise to accomplish the delivery.

The cost—including vehicle and propellant manufacturing as well as mission control—would be enormous. Even the USA manages to launch only

about one payload to deep space in a decade (e.g.: Galileo, Jupiter, 1989; Cassini, Saturn, 1997; New Horizons, Pluto, 2006; Juno, Jupiter, 2011). The vast majority of rocket launches are incapable of escaping Earth's orbit. Even lunar distance is rarely achieved.

The damage to the earth's environment as well as the human economy from dedicating the necessary resources to this endeavour would be untenable. Judging from the population statistics at

<https://www.worldometers.info/world-population/>

about 135,000 people around the world will die today, comprising on the order of 10,000,000 kg of bodies to be delivered to deep space each and every day.

By comparison, the payload mass of the Juno probe now orbiting Jupiter was only 3,625 kg, whereas just the propellant for the first stage of the Atlas V launch vehicle to deliver Juno was over 284,000 kg.

[https://en.wikipedia.org/wiki/Juno_\(spacecraft\)](https://en.wikipedia.org/wiki/Juno_(spacecraft))

https://en.wikipedia.org/wiki/Atlas_V

What would happen to the living people on Earth if 800,000,000 kg of rocket propellant were combusted in its atmosphere each and every day?

HUMAN FACTORS: AN ANTHROPOLOGIST REFLECTS ON *PLANET OF PEOPLE*

Lisa Messeri

Lisa Messeri is an assistant professor of sociocultural anthropology at Yale University. Her research concerns how science and technology stretch our imagination of what place is and what it means to be in place and in the world. Messeri's first book, *Placing Outer Space* (2016), is an ethnography of planetary science, studying how scientists transform planets into worlds. Her current research, supported by an NSF grant, focuses on the virtual reality community in Los Angeles.

When I was an undergraduate studying aerospace engineering, I took a class called 'Human Factors in Engineering'. It was toward the end of my degree and I was already cooling toward the idea of being an engineer—it felt too sterile, inhuman. What a treat to get to think about the human! As it turns out, the class mostly walked through case studies of how human error led to catastrophic disasters for otherwise (from the engineer's perspective) perfectly sound and functioning technical systems. Trust the machine, the course preached, doubt the human.

I was not satisfied. I went back to graduate school to study anthropology and eventually decided to learn from and write about humans who care about outer space; mostly scientists but a few engineers. If their bodies kept them grounded on Earth, how did their imaginations enrich the vast and mysterious cosmos? How did planets, distant and invisible, become worlds and perhaps even destinations? Perhaps one could say I was interested in (from the anthropologist's perspective) human factors.

My long engagement with these scientists has shaped my thinking about the planetary as a lively entity. And yet, *Planet of People*, constructed as it is by either frozen corpses or 3D-scanned individuals that remain representationally fixed in a moment in time, strikes me as a provocative irony for thinking about a lifeless planet. On this planet, the human factor is reduced to inorganic materiality.

Think of Carl Sagan who romantically observed, ‘we are made of star-stuff’. He offered an image of connection, of our bodies entwined with all that surrounds us, reminding us that we are elemental and thus we bring the elemental to life. But, what might it mean to flip the equation and suggest that star-stuff (planetary-stuff) is made of us? At what point do frozen bodies, floating and entangled, drawn together by gravity, revert—if not chemically then conceptually—to the essence of creation?

Precisely because the bodies are frozen and fixed the possibility of such a cathartic inversion is denied. Frozenness denies the organic and the ability to decompose, to become earth. This makes *Planet of People* deeply (and compellingly) inhuman. Are bodies floating without context still humans? What are bodies once they are extracted from their terrestrial grounding and placed in perpetually suspended animation? While illustrating that the mass of these bodies could theoretically become planetary, *Planet of People* rejects an understanding of humanness invigorated by our connection with the lively and material stuff of Earth. These floating inorganic humans refuse an understanding of the planetary as a living and growing entity. *Planet of People* can change geomorphically, but it is always already dead. Is this the fate of any planet on which people assume they are separate from the processes by which a planet is enlivened? Is this the fate of Earth?

While writing this reflection, I looked up ‘Human Factors in Engineering’ in the course catalogue of my undergraduate institution and I found out that the title has changed to ‘Human Systems Engineering’. This semantic slip shifts the human from an element to be minimised and controlled to that which itself needs engineering. The human is placed back in the system, part of the machine we must both trust and doubt. *Planet of People* is a human system, but one that cedes control to forces beyond the human exposing the very inhumanness of planetary engineering.

MEDITATION ON DEATH

Michael P. Oman-Reagan

Michael P. Oman-Reagan is an anthropologist, artist and activist. After completing B.A. degrees in anthropology and religion he earned an M.A. degree and PhD candidacy in anthropology. The *Library Journal* named him a Mover and Shaker for his role in co-founding The People's Library, the free library of Occupy Wall Street. He is a founding board member of the JustSpace Alliance, serves on advisory boards for METI International and the Astrosociology Research Institute and is a member of the International Academy of Astronautics' SETI Permanent Committee.

How can we confront the limitless wonders of the cosmos if we can't confront our own death?

Julijonas Urbonas asks us to imagine our bodies launched into space with many other bodies, all aggregating together to form the artificially constructed *Planet of People*. Our bare, fragile, delicate soft bodies are not made for outer space. We are barely able to survive in most conditions here on Earth, particularly in the increasingly deadly conditions we are imposing on each other and our own planetary habitat.

If you think about your body being launched into space, you would be right to imagine that it means you are dead. You might laugh this off. Ha! Launching our bodies into space, using bodies as building blocks in space, isn't that clever. But what is happening underneath the satisfaction we get from intellectualising and abstracting this idea, a satisfaction cloaked with our pride from feeling special because we *get it* and we're even a part of the artwork? What lurks beneath the privilege we feel because we're able to participate in exhibitions like this and learn about them? What happens beyond the ego boost we might get as one of those who appreciates the grand project we call contemporary art? Underneath all of this aren't we just afraid to confront what this really means? I will die one day. You will die one day. We will all die one day.

It is important to think about death before we die because it's harder to do it after. Perhaps after you've thought about having your body la-

unched into space and thought about a planet made of bodies and considered how uncertain the future is for us and for our planet, you may want to take a moment to confront and start to come to terms with the reality of death. Meditating on death has many benefits, including helping us reduce attachment to our bodies and all of the impermanent things that we ignorantly believe will bring us happiness. Meditating on death is also a technology of the mind that Buddhists have been using for over 2,500 years.

As part of the Mahayana Buddhist practice, Tibetan Buddhism does not only seek enlightenment of the individual but also an end to suffering for all beings. In the Tibetan Buddhist tradition, the steps in this path to enlightenment and the end of suffering were collected into a series of stages called the *Lamrim* (*Lam* meaning path and *rim* meaning stepped or graduated). Part of the *Lamrim* path is analytic meditation on specific topics to teach us about our minds, the causes of suffering, the way attachment to worldly concerns prevents happiness and how to end that attachment and suffering. These meditations help temporarily reduce the attachments that cause suffering until we realise the truth of emptiness. That realisation of emptiness eventually pulls up attachment by the root like a weed and prevents it from re-establishing itself again. A key meditation in the *Lamrim* that develops this direct realisation of the emptiness of inherent existence is the meditation on death.

To begin, sit either in a classic meditation position (vajra, lotus, easy cross-legged, etc.) or in a chair. Ensure your back is upright, but your shoulders are relaxed. Relax your legs, hips, stomach, jaw and face. If you're in a chair put your feet flat on the ground and position yourself just on the front edge of the chair so that your hips roll forward and your back is naturally upright. Keep your head level but relaxed, as if a light string is pulling the very top of your head gently up. Your shoulders should also be level. The mouth is closed and your tongue is naturally against the top of your mouth. Hold your eyes a bit open but relaxed. If you're sitting on the ground place your left hand in your lap palm up, and your right hand on top of it palm up, then touch your thumbs gently as if just holding a delicate piece of paper between them. This hand form creates a small triangle or oval shape. If you're on a chair, place your hands like this as well or place your palms comfortably on the top of your thighs.

To begin the meditation on death as taught by Venerable Thubten Chodron, a nun in the Tibetan tradition, first we set our motivation for meditating. You might want to say something like: 'By meditating I

will transform my mind for the benefit of every living being. I will seek enlightenment and the liberation of all beings from suffering, including myself. The most important thing I can do is to avoid harming any other being. If I am attached to material possessions, praise, approval, prestige, reputation and the pleasures of my senses I am wasting my time and this precious opportunity I have as a human being. By letting go of those attachments I will cultivate compassion and wisdom and love’.

Next, in order to focus and calm your mind, do a breathing meditation. Feel your body sitting on the floor, cushion or chair. Be inside your body. Be here, in the place you are, in the body you are in. Scan through your body from your feet to your legs to your stomach to your shoulders to your neck and head and face and relax any place that is holding tension, your meditation posture should be firm but relaxed. Then just breathe normally and naturally. Not deep breathing, not special slow breathing, just let the breath occur. As you let the breathing happen, observe it. Watch the breath, notice when it pauses and resumes and be content to just sit and breathe and observe the breathing. It’s good enough to just be here breathing. You don’t need to do anything; you can just sit here and breathe. If something comes up like a sound, a feeling or a thought, just acknowledge it and then go back to observing your breath. Don’t get caught up in any sensations or thoughts. Continue watching the breath for a few minutes.

Now that you have calmed your mind a bit, you are ready to meditate on death. The goal here is not to be sad or depressed or to think about hopelessness or generate anxiety. The goal is to see reality, the fact that we are mortal beings. Thinking about mortality helps us to have the right priorities so that we don’t waste our time on things that distract us from making our life meaningful.

Thinking about your own life consider the following points:

1. Death is inevitable and unavoidable. We can’t prevent our death or extend our lifespan once we are about to die. With every moment we are closer to death. You and everyone you know will die one day. This is a good reason to start transforming our minds now in order to work for freedom from suffering for ourselves and all beings. Imagine your body floating in space, frozen and how that body is no longer any use to you.

2. The time of your death is not known. People die in old age, in middle age, as do young people and children. Think about the people you

know who have died, how old they were when they died and what they were doing when they died. It's very hard to stay alive, but very easy to die. Our bodies are so fragile, they can be destroyed by the smallest things. Imagine everyone you know floating in space, cold and dead.

3. None of the attachments in this material world can help you when it's time to die. Your money can't help you, your clothing and jewellery can't help you, your cars and houses can't help you—you can't bring any of this with you. Your friends and relatives can't help you—they have to stay here when you leave. Your body can't help you—it is no longer useful to you if it is buried, cremated or launched into space. No matter how nice your skin and hair, how much you go to the gym, your body is useless when it's time to die. If your body were floating in space, would it matter what your hair looked like?

Now imagine a circumstance where you are dying. Where are you? Imagine yourself floating in space with thousands of other dead bodies. Who is with you, where are your friends and family? How do you feel as you are dying, what's going on in your mind? Since this will happen one day, what is important in your life now? What do you regret doing in your life? What have you done that you feel good about? While you're still alive what do you want to do? How can you prepare for your death? What are your priorities while you are still alive?

As you consider these questions in meditation and carry them into your everyday life, think about whether there is anything that can actually help you with the suffering that we all experience. How can you help to liberate yourself and all beings from suffering? As you consider what you want to do next, today, right now, imagine your body launched into space, lifeless and cold, gathered together with all the other bodies in a planet of corpses.

(For the meditation on death, other *Lamrim* meditations and an explanation of the path to end suffering in the Tibetan Buddhist tradition see Ven. Thubten Chodron's book *Guided Buddhist Meditations: Essential Practices on the Stages of the Path* (2007) and the *Library of Wisdom and Compassion* book series (2017) by H.H. the Dalai Lama and Ven. Thubten Chodron).

He Renke

He Renke earned his master's degree in architecture from Hunan University in China. He served as a visiting scholar at the Institute of Architecture and Design of the Royal Danish Academy of Fine Arts in Copenhagen and North Carolina State University's School of Design. Currently, Renke is the dean and a professor at the School of Design of Hunan University. He also serves as vice-chair of the China Industrial Design Association (CIDA), director of the Chinese Industrial Design Education Committee and director of the China-Italy Design Innovation Center in Hunan. He has been a juror in the Red Dot design competition since 2008 and the Red Star design competition since 2006.

Planet of People is a very intriguing and avant-garde concept. The physical conditions of outer space mean that the unprotected human body can only exist there as non-living matter. Based on the development of artificial intelligence and quantum communication, perhaps the eternal life of humans can exist by way of atoms. People on Earth can be duplicated on this planet in outer space to form two mirrored parallel universes. On it, humans could communicate between themselves and with their mirrored citizens on Earth, forming a wonderful, eternal, endless...

IF ALIENS WERE TO VISIT THE EARTH

Ma Yansong

Ma Yansong is the Principle Architect and Founder of MAD Architects. Through his work, Ma is committed to creating a vision for the city of the future that is inspired by the spiritual and emotional needs of its residents. Over the past sixteen years, Ma has gained worldwide attention in the architecture field for his international practices with cultural consciousness. Signature projects include: Harbin Opera House, the Lucas Museum of Narrative Art in Los Angeles and the Absolute Towers in Mississauga. Recent exhibitions include 'Mad X', Centre Pompidou, Paris (2019); 'Tunnel of Light', Echigo Tsumari Art Field Triennial, Japan (2018); 'Fifth Ring', Milan Design Week, Milan (2018); 'Micro Garden', 15th Venice Architecture Biennale, Venice (2016); 'Verso Est: Chinese Architectural Landscape', MAXXI, Rome (2011); 'Living', the Louisiana Museum of Modern Art, Copenhagen, Denmark (2011); 'Feelings Are Facts: Olafur Eliasson + Ma Yansong', Ullens Center for Contemporary Art (UCCA), Beijing (2010); 'China Design Now', the Victoria and Albert Museum, London (2008). In 2019, Ma was invited as a special speaker in 'In Our Time: A Year of Architecture in a Day' conference held by the Metropolitan Museum of Art, New York. Ma's works are part of numerous public collections, such as M+ Museum, Hong Kong and Centre Pompidou, Paris.

Many sci-fi films envision a future of humans' migration to different planets. However, no matter how the territory of human civilisation expands, the imagination of the future is still generic, which turns out to be a product of our limited reasoning. With a critical attitude towards our present reality, I asked myself, if aliens were to visit Earth, how would they perceive our present living conditions and human civilisation? I tried to find the answer through my architectural practice.



MAD Architects, *The Floating Island*, 2001 (proposal)



MAD Architects, *Superstar: A Mobile Chinatown*, 2008 (proposal)



MAD Architects, *Ordos Museum*, 2005-2011



MAD Architects, *Harbin Opera House*, 2010-2015



MAD Architects, *MAD Martian Collection*, 2017



MAD Architects, *Chaoyang Park Plaza*, 2012-2017

MAGNIFICENT DESOLATIONS: IMAGINING AMBITION, ANXIETY AND INDIFFERENCE IN OUTER SPACE

Joseph Popper

Joseph Popper is an artist working across film, installation and photography. Focusing in particular on human activities in outer space, he explores the shaping of experiences and imaginations in relation to social and technological developments. His works make the 'found' fantastic, rendering simple materials and reframing landscapes to create playful fictions.

Joseph is a PhD candidate at the ECAM Graduate School at the Academy of Art & Design FHNW in Basel, Switzerland. He has an interdisciplinary background in art and design, graduating with an MA in Design Interactions at the Royal College of Art in 2012. His works are exhibited internationally, including at La Gaîté Lyrique (Paris), Baltic Centre for Contemporary Art (Gateshead), La Panacée (Montpellier) and the Vitra Design Museum (Weil am Rhein).

On the 24th of July, 1969, as Apollo 11 astronaut Buzz Aldrin took his first steps upon the surface of the Moon, he surveyed the alien landscape before him and described a sight of 'magnificent desolation'. In doing so, Aldrin planted the words in the minds of millions of people watching and listening to the mission back on Earth. From the early 20th century and into the present, planetary desolation remains pervasive as a visual and rhetorical theme shaping popular imaginations of outer space. Desolation can mean destruction or emptiness, and both images interact together to heighten a sense of agency and urgency among certain space industry actors with ambitions to commercialise and colonise the cosmos. By surveying visions of ambition and anxiety about futures on and beyond Earth, this essay describes the stabilising role of magnificent desolations in a predominant American-European space imaginary. Imagining desolation is then explored as a disruptive force, where the cold and lethal indifference of space environments to human life exposes troubling contradictions in common narratives that are rendered both dated and flawed.

The first image of desolation is one of destruction, forming the root of real fears for the survival of humanity and the shape of catastrophic future scenarios haunting the present. In such visions, Earth is imagined as a small, fragile and dying planet subject to disaster by human, environmental or extra-terrestrial forces. Desolation represents a different ‘existential threat’ to the future of humankind, which can also be framed as the end of the world happening at different speeds—a slow or fast apocalypse.¹ Space industry actors and space colonisation advocates use different imagery and language to render these threats tangible.

One important image is a vulnerable Earth in the face of a catastrophic extinction event. The prospect of a dramatic, planetary disaster has led many spaceflight advocates to reason that becoming multi-planetary is necessary to ensure humankind’s survival in the very, very long run. Space X leader Elon Musk is one of the chief proponents here, suggesting ‘two fundamental paths along which history will bifurcate’, where humanity either spreads out into the universe or is wiped out altogether.² Central to this reasoning is the long-term probability of an asteroid impact, an image that ties various nuances of spaceflight advocacy together. The asteroid is a perpetual horror in collective pro-space imaginations, grounding an acceptance that ‘if we stay [on Earth] eventually we will die’.³ More interestingly, such contemporary expressions of anxiety further tie the asteroid to the atom bomb and humanity to the prehistoric. The dinosaurs lack of a space programme is, however wryly, suggested by some to have contributed to their demise.

Whether man-made or extraterrestrial, the representation of a singular, monolithic threat to human existence is arguably a legacy of the Cold War era. This is evident when comparing speculative imagery of sublime impact devastations. Recent depictions of large asteroids colliding with Earth are markedly similar to the paintings by Chesley Bonestell of nuclear disasters across international cities made for the magazine *Collier’s* in 1948. Written that same year, the words of Arthur C. Clarke set a precedent for spaceflight advocacy by reasoning ‘as long as it was confined to Earth, humanity had too many eggs in one rather fragile basket’.⁴ Here, the asteroid and atom bomb become interchangeable as harbingers of Earthly abyss.

A second projected threat is resource finitude in the midst of unrelenting, unsustainable human activity. Blue Origin founder Jeff Bezos states simply, ‘Earth is no longer big, humanity is big’ to convey the planet’s incapacity to support the exponential growth of the human population and corresponding levels of material consumption.⁵ When

unveiling a Blue Origin lunar lander prototype in May 2019, Bezos based his argument on basic arithmetic and statistical extrapolation to reason ‘we will reach the end of the earth’s energy’.⁶ This projection repeats one given by a group of scientists, economists and industrialists named The Club of Rome and their seminal book *Limits to Growth*, published nearly fifty years ago in 1972. However, foregrounded in Bezos’s concerns are what these limits imply for ways of life in the ‘developed world’ as we know them. The end of energy means rationing, stasis and the prospect of our grandchildren living worse lives than us—in his words, ‘a bad path’.⁷

For Bezos and others, outer space represents the sort of *spatial fix* that our present condition demands.⁸ ‘If we move out into the solar system’, he says, ‘for all practical purposes, we have unlimited resources’. This sentiment is echoed by engineer Robert Zubrin who connects material finitude with endless conflict. ‘Only in a universe of unlimited resources’, says Zubrin, ‘can all men be brothers’.⁹ The space entrepreneur Peter Diamandis further describes Earth as a ‘crumb, in a supermarket filled with resources’.¹⁰ Both Zubrin and Diamandis align with Bezos by using Earthbound finitude to frame outer space as the key to a future of endless energy, economic growth and universal peace. Here, ‘horizon[s] of extinction’ serve the promise of outer space as an open frontier of infinite material potential, waiting for human exploration, exploitation and prosperity.¹¹ This turn signifies a double-exposure of triumph over catastrophe, where, as sociologist James Ormrod conveys, ‘the horrific element’ of the disaster fantasy ‘is brought into being only in relation to its solution’.¹²

The notion of material potential leads to the second image of desolation, one of emptiness imagined magnificent by a promise of transformation and exploitation through human technological intervention. Looking out beyond Earth, the anxiety for human survival turns readily into ambition bound to notions of progress.¹³ For spaceflight advocates, an empty alien landscape becomes a screen for projecting myths and fictions rooted in American-European histories and ideologies. One example is the settler myth, inspired by Robinson Crusoe, where wilderness is waiting to be transformed by the technical ingenuity and industry of enterprising individuals. Crusoe is conveyed as the symbol of a mobile and modern man, engaging in ‘confrontations between technology and nature’, an image that rhymes with what Ormrod defines as the ‘omnipotent’ fantasies of the pro-space movement ‘about control: owning, consuming, taming or conquering something’.¹⁴

Fictions describing control and transformation of desolate landscapes resonate pointedly with the frontier which, together with progress, form arguably the most important myths undergirding both American ideology and commercial spaceflight advocacy.¹⁵ As the notional ‘final frontier’, outer space replaces the America of the past as a place of opportunity, pioneering and rugged individualism—activities and associations pervasive in American history and central to American national identity.¹⁶

Progress can be briefly defined as the inevitable and necessary movement forwards in the direction of a desirable future, one often driven by technological advance. In this sense, myths of the frontier and progress frame spaceflight as not only a natural endeavour but a moral imperative. In doing so, they transform the desolate landscape of another planet or the black void of outer space into a ‘green promised land’.¹⁷

The third image of desolation is one of indifference, bringing contradictions of commercial spaceflight imaginaries to the fore in a glaring and troubling friction. Here, desolation represents the cold, dark and lethal ambivalence of hostile space environments to human life and human dreams. When the first humans land on Mars, freezing temperatures and unbreathable air present the first of multiple, immediate existential threats. The designing and inhabiting of actual space stations since the 1970s reveal outer space as a harsh and unforgiving place, where living becomes a series of unglamorous and painstaking productions. As designer Fred Scharmen surveys, near and far future designs illustrate keeping humans alive as the primary purpose of any extraterrestrial architecture. Through its depiction of a future space mining crew, the science fiction film *Alien* (1979) is also symbolic of what designer Regina Peldszus describes as a pragmatic post-Apollo turn, where outer space is experienced not as a frontier of dynamism, but a dangerous state of ‘stasis’ that mundanely and cautiously endures—a stasis similar to what Jeff Bezos, Robert Zubrin and others are pitching to escape by building towards futures beyond Earth.¹⁸

The hostile environments of outer space and the material practices of basic survival they entail, further expose the master narratives of the pro-space movement as ‘retellings of North American and European colonial and frontier narratives as analogues: the adventures of white men of the last 500 years replayed in a cosmic context’.¹⁹ I argue such analogous narratives are disrupted by the cosmic indifference of extraterrestrial landscapes, where these stories are rendered not only out of time but out of place. The right to a life without limits or to be ruggedly individual in the image of Robinson Crusoe is irreconcilable with

the likelihood that—on the surface of Mars or floating in a manufactured space colony—every molecule of air you breathe will be subject to a form of transaction,²⁰ and any architectural exterior space will be ‘simply more interior’.²¹ In other words, contrary to pro-space ambitions of escaping limits, the ambivalent environments of outer space determine constraint and containment as the defining characteristics of sustaining human life anywhere but Earth.

Imagining planetary desolation is central to fortifying the ambitions of those advocating for humankind to become a future spacefaring civilisation. Studying such imagery also helps to grasp why this predominant spaceflight imaginary is so pervasive and powerful. Magnificent desolations play to master narratives deeply embedded in American-European ideologies by forming future visions both positive and negative. The ominous asteroid, the alien wilderness and the small Earth are tropes for conflating fears of material, cultural and existential finitude with the promise of survival, plenty and progress in an inevitable and necessary outward movement. As Ormrod articulates above, this fantastic tension becomes productive for the pro-space movement cause, where horrors of Earthbound scenarios remain close to their spacefaring solutions. However, the third image of indifference enables desolation to productively unsettle this imaginary—by exposing the simplification of its stories against the complexities of space productions both material and speculative. The absurdity of projecting frontier myths, in the midst of stasis conditions, conveys the copy-pasting of Earthbound histories onto extraterrestrial environments as incredibly untenable. Furthermore, desolations render the shared dream of colonising outer space, of escaping terrestrial limits to human existence, as arguably a resistance by influential spaceflight advocates to practising meaningful change concerning ways of life on Earth. Borrowing from media theorist Rob Coley, the cold and lethal environments of outer space frame their narratives of survival and progress as nightmarish ‘glitches’, failing to function as intended in the 21st century—out of time and out of place.²²

¹ Morton, O. (2019). *The Moon: A History for the Future*. London: The Economist Books, p. 178.

² Musk, E. (2017). Making Humans a Multiplanetary Species. In: *International Astronautical Congress*. Adelaide.

³ Welch, C. (2019) interview with author, October 22, 2019.

⁴ C. Clarke, A. (1951). *Prelude to Space*. New York: World Editions Inc., p. 19.

⁵ Bezos, J. (2019). Going to Space for the Benefit of Earth. *Blue Origin*, [online] May 9. Available at: <https://www.blueorigin.com/news/going-to-space-to-benefit-earth-full-event-replay> [Accessed February 26 2020].

⁶ Ibid.

⁷ Ibid.

⁸ Valentine, D. (2012). Exit Strategy: Profit, Cosmology and the Future of Humans in Space. *Anthropological Quarterly* 85 (4), p. 1056.

⁹ Quoted in Eisfeld, R. (2012). Projecting Landscapes of the Human Mind onto Another World: Changing Faces of an Imaginary Mars. In: C. T. Geppert, A. (ed.) *Imagining Outer Space, European Astroculture in the Twentieth Century*. London: Palgrave Macmillan, pp. 89-105.

¹⁰ Diamandis, P. (2008). *Taking the Next Giant Leap in Space*. [video] TED,

September 4. Available at: <https://www.youtube.com/watch?v=sUOBLX55h4s> [Accessed 26 February 2020].

¹¹ Rowan, R. (2015). Extinction as Usual?: Geo-Social Futures and Left Optimism. *e-flux journal* 65, May 2015, pp. 1-11.

¹² S. Ormrod, J. (2017). Space Activism: A Psychosocial Perspective. In: Dickens, P. and S. Ormrod, J. (eds.) *The Palgrave Handbook of Society, Culture and Outer Space*. London: Palgrave Macmillan, p. 390.

¹³ E. Dark, T. (2007). Reclaiming the Future. In: J. Dick, S. and D. Launius, R. (eds.) *Societal Impact of Spaceflight*. Washington DC: NASA, pp. 555-572.

¹⁴ Redfield, P. (2000). *Space in the Tropics: From Convicts to Rockets in French Guiana*. University of California Press, p. 8; S. Ormrod, J. (2017). Space Activism: A Psychosocial Perspective. In: Dickens, P. and S. Ormrod, J. (eds.) *The Palgrave Handbook of Society, Culture and Outer Space*. London: Palgrave Macmillan, p. 388.

¹⁵ Billings, L. (2007). Overview: Ideology, Advocacy and Spaceflight: Evolution of a Cultural Narrative. In: J. Dick, S. and D. Launius, R. (eds.) *Societal Impact of Spaceflight*. Washington DC: NASA, pp. 483-500.

¹⁶ E. Dark, T. (2007). Reclaiming the Future. In: J. Dick, S. and D. Launius, R. (eds.) *Societal Impact of Spaceflight*. Washington DC: NASA, p. 555.

¹⁷ Kirby, D. (2018). Final Frontiers? Envisioning Utopia in the Era of Limits. In: C. T. Geppert, A. (ed.) *Limiting Outer Space: Astroculture after Apollo*. London: Palgrave Macmillan, pp. 305-318.

¹⁸ Peldszus, R. (2018) Architectural Experiments in Space. In: Geppert, C. T. A. (ed.) *Limiting Outer Space: Astroculture After Apollo*. London: Palgrave Macmillan, pp. 237-258.

¹⁹ Tutton, R. (2018). Multiplanetary Imaginaries and Utopia: The Case of Mars One. *Science, Technology and Human Values* Vol. 43 (3), p. 527.

²⁰ Vermeulen, A. (2019) interview with author, October 24.

²¹ Sharmen, F. (2019). Mission Critical: Mars Modern. In: McGuirk, J. and Nahum, A. (eds.) *Moving to Mars: Design for the Red Planet*. London: The Design Museum, pp. 129-157.

²² Coley, R. (2018). Destabilized Perception: Infrastructural Aesthetics in the Films of Adam Curtis. *Cultural Politics* Vol. 14, No.3, pp. 304-326.

TECTONICS: SOME EPISODES CONCERNING THE RELATIONSHIPS OF PARTS AND WHOLE IN SPACE

Fred Scharmen

Fred Scharmen teaches architecture and urban design at Morgan State University's School of Architecture and Planning. He is the co-founder of the Working Group on Adaptive Systems, an art and design consultancy based in Baltimore, Maryland. His work as a designer and researcher looks at how we imagine new spaces for future worlds and who is invited into them. His first book, *Space Settlements*, published in 2019 from Colombia Books on Architecture and the City, investigates NASA's 1970s proposal to construct large cities in space for millions of people. He received his Master's Degree in Architecture from Yale University. His writing has been published in the *Journal of Architectural Education*, *Log*, *CLOG*, *Volume* and *Domus*. His architectural criticism has appeared in the *Architect's Newspaper* and in the local alt-weekly *Baltimore City Paper*.

'A live body and a dead body contain the same number of particles. Structurally, there's no discernible difference. Life and death are unquantifiable abstracts. Why should I be concerned?'

Dr Manhattan, *Watchmen* (written by Alan Moore)

1

It's 1651. An artist and a political philosopher are sitting down at a table across from one another. 'A multitude of men,' the philosopher says, as the artist is concentrating on making marks in his sketchbook, 'are made one person, when they are by one man or one person, represented'. 'Hmmm, uh-huh?' says the artist. 'So that it be done,' continues the philosopher, 'with the consent of every one of that multitude in particular'. 'Mm, so something like this, Thomas?' the artist says, turning his book around and sliding it across the table. 'Yes,' says the philosopher, sitting back in his chair, 'something like that'.

The philosopher picks up his own pen and writes a single word across the bottom of the sketch: *Leviathan*.

2

It's 1868. A woman is serving tea to her husband. 'Go to thunder with your old law books! Hehehe.' 'What's that, Eddie?' 'What?! Nothing dear Emily, I am still working on this story about a new moon, made of brick!' 'That's a lovely image, Eddie. Up close, you can see the individual bricks laid by man, but from far away, the impression on the eye is of one unity, solid as anything made by God.' 'Hmmm, indeed! And in the sky!' 'One of my students said something queer today about pieces.' 'Hmmm?' 'We were reading a lesson on tectonics when one of the students called out to ask if Earth itself might be made of parts.' 'Hrrrmph?' 'Yes, Wegener. Bright, but troublesome.' 'Hmmm'. 'What if Earth came apart?' he asked. 'Geography, in future, might be confined to the study of the region east of the Mississippi and west of the Atlantic—Earth having parted at the seams so named.' 'Hah!' 'No more study of Italian, German, French or Slavonic,' he declared, 'the people speaking those languages being now in different orbits or other worlds!' 'Hehehe!'

'You can imagine. The other students all but erupted!' 'Ahahaha! Hah!' 'Biscuit?'

3

It's 1879. A librarian is addressing a student. 'So long as there are no real translations to other worlds, Konstantin, people will resort to fantasies, ecstatic rapture and drug abuse.' 'Future technology will make it possible to overcome Earth's gravity, Master Fyodorov, and travel through the entire solar system.' 'Humanity must not be idle passengers, Konstantin, but the crew of its terrestrial craft propelled by forces the nature of which we do not even know—is it photo-, thermo- or electro-powered? We will remain unable to discover what force propels it until we are able to control it.' 'Man will find it hard to separate himself from Earth, Master.' 'The Common Task knows no compromises even with death. The Common Task is a response to catastrophes affecting all humans—that is, death and all that leads to it, Konstantin.' 'When they encounter a desert or immature, ugly world, they will painlessly eliminate it, Master, replacing it with their own world.' 'Death is a property, Konstantin, a state conditioned by causes; it is not a quality which determines what a human being is and must be.'

‘Yes, Master Fyodorov. No atom in the universe can avoid a complicated life.’

4

It’s 1955. A woman and a man are on a city sidewalk. ‘The results suggested a helical structure, JD—which must be very closely packed—containing probably two, three or four coaxial nucleic acid chains per helical unit and having the phosphate groups near the outside’. ‘Already we know all the varieties of atoms, we are beginning to know the forces that bind them together, soon we shall be doing this in a way to suit our own purposes.’ ‘I see no reason to believe that a creator of protoplasm or *primaeval* matter, if such there be, has any reason to be interested in our insignificant race in a tiny corner of the universe, and still less in us, JD.’ ‘Imagine a spherical shell 10 miles or so in diameter, made of the lightest materials and mostly hollow; for this purpose, the new molecular materials would be admirably suited. Owing to the absence of gravitation its construction would not be an engineering feat of any magnitude.’ ‘Science and everyday life cannot and should not be separated, JD.’ ‘Already the scientist is more immersed in his work and concentrates more on relations with his colleagues than on the immediate life of his neighbourhood. Yet the globe would be by no means isolated.’ ‘I am therefore reminding you of the facts, JD.’ ‘Man will not ultimately be content to be parasitic on the stars, Rosalind, but will invade them and organise them for his own purposes.’

They arrive at the street crossing. ‘JD, the question of adjusting my salary to the University scales has still not been settled.’

Notes:

Each of these imaginary dialogues has been reconstructed, whenever possible, using fragments from the speakers’ actual publicly available writing. In each case, the two speakers knew each other during the referenced year and could have had conversations with one another about their work in terms not far from those imagined here.

1

Thomas Hobbes and Abraham Bosse. Thomas Hobbes was an English philosopher of politics and society in the 17th century. Abraham Bosse

was a French artist who illustrated the cover of Hobbes's most famous work, *Leviathan*.

2

Edward Everett Hale and Emily Perkins Hale. Edward Everett Hale was an American Unitarian minister, author and abolitionist. His short stories, 'The Brick Moon' and 'Life on the Brick Moon' appeared in *The Atlantic Monthly* in 1869 and 1870. These stories are the first instances in fiction where one finds the idea of a space station. Emily Perkins Hale was Edward's wife, her dialogue here appears in 'Life on the Brick Moon' as a speculative anecdote about 'Miss Hale's' class.

3

Nicolai Fyodorov and Konstantin Tsiolkovsky. Fyodorov was a reclusive librarian living in Moscow. He was the founder of a mystical-materialist belief system that came to be known as Cosmism. He advocated for 'The Common Task' whereby he argued that science and society should devote their efforts toward making possible the bodily resurrection of every human who ever lived. To make room for all of these people, he contended that humans should try to make life in space possible. A student of Fyodorov, Tsiolkovsky was the first scientist to derive the 'rocket equation', showing that escape from Earth's gravitational field was feasible.

4

Rosalind Franklin and JD Bernal. Franklin was an English chemist and the discoverer of the double-helix shape of the DNA molecule. JD Bernal was also a chemist and polymath, whose early writings proposed the construction of large free-floating habitats for millions of people in space. Franklin was a colleague of Bernal's at Birkbeck College, University of London, where she struggled to be acknowledged (and compensated) for her experience and work.

Vidas Dobrovolskas received his PhD in Astrophysics at Vilnius University in 2013 and since 2014 has been working at the university's Institute of Theoretical Physics and Astronomy. His research concerns chemical and dynamical evolution of the oldest stellar populations in the Milky Way and the Local Group of galaxies. Dobrovolskas is a member of the Lithuanian Astronomical Union and European Astronomical Society and is responsible for astronomical outreach activities at the Lithuanian Museum of Etnocosmolgy.

The idea of the project *Planet of People* is rather unconventional but very interesting. However, its realisation in practical terms is impossible for a few reasons.

The idea of *Planet of People* is to catapult people to a specific location in space where there is no gravity, light or air. As for the air, it's relatively straight forward as there isn't any. Yet there is not a single place where there wouldn't be any gravity or light. It would be impossible to hide from the light that is perceivable to the human eye (the so-called visible spectrum), unless perhaps you hid in some well-contained box, as the visible spectrum is only a very narrow range of electromagnetic radiation, ranging from gamma-rays to radio waves. The radiation would still penetrate it in one way or another, even in a completely secure box.

It is equally impossible to hide from gravity. The term 'weightlessness' is often confused, in a sense that weightlessness means no attraction (or gravity). If that would be the case, all the spacecraft orbiting Earth would fly and disappear into the vastness of space. But, as we know, this is not what is happening. The force of gravity can be inexhaustibly weak but even if we find ourselves somewhere in the depths of space, far from any planets or stars, gravity does not disappear completely and does not reach zero.

Another very serious difficulty would be to 'glue' together this planet of human bodies. Gravity is the weakest force out of the four types currently known to science and we only feel this tangible force around some massive objects, such as planets. Meanwhile, the force of gravity created by the mass of human bodies would be very weak. Suppose a person weighs 50 kg. Then, according to Newton's law of gravitation,

it can be estimated that a person will keep another person in his/her field of gravity if their relative speed to each other does not exceed 0.1 mm per second. Therefore, even the slightest squirm would be enough for people to start moving away from each other.

But let's say that we initially hooked people up with ropes, preventing their bodies from scattering in space. If we take all the people currently living on Earth (almost 8 billion), the total body mass would be 300-400 million tons. By launching them all into space assembled in a single blob, without compressing them too much, we would get a sphere around 2-3 km in diameter. The speed, which would be enough to break away from such a 'planet' would not exceed 25 cm per second. So, even in that case, *Planet of People* would be a very fragile entity—people would easily break off and fly away. To maintain a stable shape of *Planet of People* it would be necessary to gather at least a thousand times more people than are currently living on Earth.

It may be possible to create *Planet of People* in the distant future, but for now, even if we persuade all people to take part in this project, we would only get a small asteroid.

This is an assessment from a scientific point of view, but there are certainly no limits for thought and imagination.

PLANET OF PEOPLE: A TIMELY PROVOCATION

Craig Jones

Craig Henry Jones is a PhD Candidate at Lancaster University. He completed his MRes project entitled 'Ethnofuturism: Addressing the Cultural Divide in Outer Space' in 2016 and his PhD builds on this work. His thesis considers how outer space is (re)constructed through different socio-cultural imaginaries, centring on asteroid mining as a new extractive 'frontier'. His work has engaged with both New Space Economy actors and Ethnofuturist artists and made use of multiple methods spanning a range of media, exploring how these futures are constructed and contested through different socio-cultural positionings. He has presented work at the RGS-IBG, SiP, POLLEN and EASST. His work has been funded by the ESRC 1+3 Studentship.

The past two decades have seen space activities becoming increasingly internationalised. The establishment of the 'New Space Economy', commercialisation of space technologies, increasing space debris, chances of multi-planetary biocontamination and its ethical implications, renewed discussions of 'colonising' space (and the baggage this entails) and the (re)turn to notions of terraforming all comprise the increasingly rich and diverse discussions taking place in this area. These topics—amongst others—come together to offer numerous challenges across multiple disciplines. These challenges are invoked and provoked further through the creative exploration offered by the project *Planet of People*.

With these numerous overlapping and, at times, divergent issues in mind, it is perhaps art that is best suited to help us get to the core of these problems. The strength of art such as *Planet of People* lies in its ability to transcend the limitations of languages and formulae, 'speaking' towards matters that escape easy articulation. Furthermore, art allows for its subject matter to be thought of anew, encouraging—or demanding—that the engaged viewer rethink, re-engage or reimagine and thereby challenge and (re)define the viewer's ideas on the subject matter. Alongside the topics outlined above, the project urges thoughts

on physical eschatology, astroanthropocene, extraplanetary forces, decomposition (or the lack thereof), (inter)planetary and much more.

The ability to communicate that which escapes the confines of language and to renew discussion and thought on numerous topics is a strength of *Planet of People*, irrespective of what one believes vis-à-vis the feasibility of this project in reality. Indeed, simply considering the question of feasibility entices us towards manifold other deliberations. Whilst the weak gravitational forces between bodies would indeed draw them together when in relatively close proximity, one then thinks of how the bodies would have ended up in space to begin with, by what means they were sent there and what reasons underpinned the exercise. Consequently, not only does *Planet of People* draw us to questions about the above topics but—through thoughts of ‘how’ and ‘why’—also towards reflections on societal norms and understanding(s) of outer space. Would bodies be fired up en masse? Would the bodies be derived solely from Earth or would the planet be comprised of bodies from ‘Terran’ settlements throughout the solar system? Or would bodies be fired up one by one? This last question elicits thoughts of global planetary and celestial mechanics; to fire bodies up one by one would complicate or prevent the bodies from coming together in space. It is difficult to create a new planet of bodies if you fire people from Earth as it rotates on an axis whilst travelling along an orbit amongst the orbits of other planet(oid)s. Furthermore, the weaker forces present throughout the solar system would result in a ‘fired’ body potentially travelling on its trajectory in perpetuity—because there is little gravity, drag or friction to help bring it to a stop. By encouraging us to consider these matters, *Planet of People* not only serves as a provocation regarding matters of outer space and its associated activities and society but also urges us to question our assumptions about Earth-based dispositions, betraying the terracentrism of our thoughts.

Moreover, *Planet of People* demands that we contemplate physical eschatology. Evoking the idea of the body as corpse inevitably leads one to thoughts of decomposition and how this may—or may not—operate in outer space. Imagining a body in space often conjures ideas and images of stillness and timelessness, of bodies untroubled and unaffected by decay and rot. Decomposition may be a *de facto* notion when conceiving of a body’s physical ‘afterlife’ upon Earth. However, *Planet of People* pushes us to consider these processes anew by placing the body in a vastly different environment. By shifting the setting wherein a body finds itself, we are forced to consider how this will influence and (re)shape the decomposition of the body, coaxing us further from

our default, terracentric modes of thought upon the subject. Biological processes that enable and enhance the decomposition process on Earth would be absent on *Planet of People*, even bodily fluids would freeze solid in the cold confines of outer space. Bodies would also be subject to other forces that are similarly otherwise absent in a terrestrial setting. Although the microbes that speed up decay on Earth would be missing, one would have micrometeorites striking *Planet of People*, pockmarking and breaking down the bodies at its surface. Solar radiation would also take a toll, gradually breaking down some biological matter such as cell walls and perhaps operating in manners that are, as yet, unpredictable due to the ‘alien’ nature of the process and environment. Consequently, we may wish to consider whether the degenerative processes that would affect *Planet of People* should still be conceived of as ‘decomposition’ or if they would more fittingly be referred to as ‘erosion’ within this new setting. By shifting our thinking from ‘decomposition’ to ‘erosion’, *Planet of People* also provokes an engagement with, and rethinking of, the temporalities with which we typically construe the degenerative processes of decay, conceived as they are through terracentric dispositions.

Ultimately, *Planet of People* is an extremely provocative piece that comes at a deeply pertinent time for the space sector. *Planet of People* expertly employs the artistic medium to spur us toward an engagement with numerous topics through the speculative deliberations it elicits. It allows us to encounter innumerable issues and topics through its imagery, transcending language and demanding that a multitude of topics be (re)considered. It brings up questions on planetarity, celestial mechanics, outer space, the body and societal norms. Urging us to rethink all of these areas necessarily draws the viewer into interrogating their assumptions on these issues, culminating in a challenge to the terracentrism that underpins the *de facto*, normative assumptions we—often unquestioningly—adhere to in daily Earth-bound life.

Zheng Yongchun

Dr Zheng Yongchun is a professor and planetary scientist at the National Astronomical Observatory of the Chinese Academy of Sciences (NAOC). He is an active popular science writer. Dr Zheng was appointed as the Brand Ambassador of China Science Communication Program in 2016, as well as the Chief Science Communication Expert at China Association for Science and Technology. He served as the first Chairman of the board of Hong Kong Scholars Association, Vice-chairman of the China Association of Science Writers, Council of Youth Innovation Promotion Association at Chinese Academy of Sciences (CAS), and Youth Council of the Future Forum.

In the past, Dr Zheng served as the secretary of the chief scientist of China's Lunar Exploration Program, for which he received an award of Outstanding Contributor of the program. He is the co-founder of Youth Astronomical Forum of the Chinese Astronomical Society in 2012, the secretary of the Lunar and Planetary Science Laboratory of the Macau University of Science and Technology, and the Lunar and Deep Space Exploration Key Laboratory of CAS. Dr Zheng has received several awards, including the Karl Sagan Medal, the Top Ten Science Communicator prize in China, the 2016 Chinese Youth Leaders, the Excellent Member prize of YIPA, CAS, the CAS President Prize in 2005 and the Outstanding Contributor Prize for China's Chang'E-2 lunar mission.

1. The Lagrange point between Earth and Moon is not permanently dark. The Chinese Queqiao relay satellite is already orbiting in this area and it utilises solar power to generate electricity.
2. From my point of view, the idea of relocating humans to other planets is provoked by the unknown dangers that Earth is facing, as well as discovering habitable planets for colonisation. We have been launching spacecraft into orbit around the Sun and there are already many man-made objects in the universe, including the Tesla sports car that was sent into orbit around the Sun by Elon Musk. What would be the purpose of forming an artificial planet with human bodies?
3. After a large number of human bodies have been sent to space, the reason they move towards each other may not be due to weak gravity but

rather to their different directions of movement that cause them to collide with each other and condense.

4. Can the human body be preserved intact in space for a long time? The human body is composed of organic matter, which will be broken down into various particles and gas molecules under the action of cosmic rays.

THE LSA TEAM

Founder:

Julijonas Urbonas

Lives and works in Vilnius

Julijonas is an artist, designer, researcher, engineer, lecturer. He is the former prorector of arts at Vilnius Academy of Arts and the CEO of an amusement park in Klaipeda. For more than a decade, he has been working between critical design, amusement park engineering, performative architecture, choreography, kinetic art and sci-fi and has been developing various critical tools for negotiating gravity: from a killer roller coaster to an artificial planet made entirely of human bodies. As part of his research, he has coined the term ‘gravitational aesthetics’, which involves manipulating gravity to create experiences that push the body and imagination to the extreme. His work has been exhibited internationally and has received numerous awards, including the Award of Distinction in Interactive Art, Prix Ars Electronica 2010. His works have been acquired by private and museum collections.

Curator:

Jan Boelen

Lives and works in Karlsruhe

Jan Boelen is a curator of design, architecture and contemporary art. He is Rector of Karlsruhe University of Art & Design (HfG), artistic director of Atelier LUMA and the founder and former artistic director of Z33-House for contemporary art & design. He has curated the 4th Istanbul Design Biennial, School of Schools (2018), and was the initiator of Manifesta 9 (2012) in Belgium. Over the years he has been fashioning projects and exhibitions that encourage visitors to look at everyday objects in a novel manner. Boelen recently edited *Social Matter, Social Design: For Good or Bad, All Design is Social* (2020), in which his writing addresses the implications of

design in everyday life and how design as a discipline is shaped by artistic practices.

Assistant Curator:

Milda Batakytė

Lives and works in London

Milda works as an independent curator and assists the artist Mona Hatoum at her studio in London. She received her MFA degree in Curating from Goldsmiths, University of London in 2019. Milda's most recently curated exhibitions include: 'The Echo System' (Thames-Side Gallery, London, 2021), 'More More More Morph!' (Chalton Gallery, London, 2019), 'Coming to Terms with Sociotechnical Discrepancies' (12 Star Gallery, London, 2018). Her curatorial research revolves around current socio-political questions and how these feed into making and exhibiting art; her curatorial research outcome is abstract and lyrical, and therefore can have an open ended interpretation. In the past, she has gained work experience at White Cube (London), Lisson Gallery (London) and Peggy Guggenheim Collection (Venice), among others.

Commissioner:

Julija Reklaitė

Lives and works in Vilnius

Julija is the director of Rupert – centre for art, residencies and education. Between 2015 and 2019, she was the Lithuanian Cultural Attaché in Italy. In 2019, Julija worked as a commissioner of the Lithuanian Pavilion for the Triennale di Milano. She is a co-founder of the public organisation, Architektūros Fondas, which she directed between 2009 and 2012. She has worked on various projects in the fields of architecture, exhibition design, cultural diplomacy, contemporary art and theatre. Reklaitė studied at Vilnius Gediminas Technical University,

where she obtained a PhD in Architectural History and Theory. She is the author, co-author and editor of various publications and articles.

Laboratory design:

Isora x Lozuraityte Studio for Architecture Live and work in Vilnius

The studio is led by Petras Išora and Ona Lozuraitytė. The creative duo work within the expanded field of architecture exploring the built environment, public space and infrastructure, landscape, material management and exhibition design and curating. The duo were one of the co-curators for the Baltic Pavilion, the joint Estonian, Latvian and Lithuanian representation at the 15th International Architecture Exhibition, La Biennale di Venezia (2016). The studio has developed exhibition architectures for Pakui Hardware, Jonas Mekas, Laure Prouvost and many others. Ona and Petras are also one of the co-founders of the project platform KILD that has won a number of international architectural competitions.

Programming, Graphic Design:

Studio Pointer* Live and work in The Hague

Studio Pointer* is an interactive media design studio by Asya Sukhorukova and Jakob Schlötter. Jakob and Asya both received their degrees in Graphic Design at the Royal Academy of Arts in The Hague. Their work revolves around experimental storytelling and strives to explore the hidden potential in contemporary technologies, re-mixing found materials and researching different aspects of new media's role in anthropology and culture. In addition to their independent practice, Asya and Jakob have developed various projects that range from sound and website design and image making to the development of complex digital environ-

ments and interactive installations. They have worked on commissions for clients in cultural and commercial sectors. Works by Studio Pointer* have been showcased in various exhibitions and festivals in the Netherlands and abroad.

Pavilion Producer:

Mindaugas Reklaitis

Lives and works in Vilnius

Mindaugas is an architect, co-founder of the architecture office, sprik and an architect at the National Gallery of Art, Vilnius. He is a Ph.D. candidate at the Vilnius Academy of Arts researching performative architecture as critical spatial practice. In addition to over ten years of architectural practice designing award-winning buildings in Lithuania and abroad, he has been involved in projects produced by various NGO institutions. He was a project manager of the Lithuanian Pavilion for the 16th International Architecture Exhibition, La Biennale di Venezia (2018) and a co-producer and architect of Golden Lion Award-winning Sun & Sea (Marina), presented for the Lithuanian Pavilion at the 58th International Art Exhibition, La Biennale di Venezia (2019).

Communication:

Jogintė Bučinskaitė

Lives and works in Vilnius

Jogintė Bučinskaitė works as an art critic and communication curator in multiple projects of contemporary art, cinema and other fields of culture. She graduated in Journalism and received her MA in Culture Management and Cultural Policy. She is currently a PhD candidate in the Representation of Contemporary Art at the Lithuanian Culture Research Institute. Jogintė has also worked for the Lithuanian National

Television, edited publications and she actively publishes various texts in Lithuanian and international cultural media platforms.

Vilius Balčiūnas

Lives and works in Vilnius

Vilius Balčiūnas is an architect, working in the field of communication at Architektūros Fondas, a non-profit organisation focusing on architecture, education and culture. For more than five years, he has been actively involved in the European Architecture Students Assembly network, which is based on self-organisation and alternative education practices. Vilius studied architecture at Vilnius Gediminas Technical University and received a Master of Architecture degree in the 'Urban projects, urban cultures' programme at Katholieke Universiteit Leuven.

ACKNOWLEDGEMENTS

We would like to thank the following people for their generous contributions to this publication:

Michael Clormann
Ni Cui
Régine Debatty
Vidas Dobrovolskas
Poppy Dongxue Wu
Hu Fei and Jia Liu
Li Geng
Theodore W. Hall
Michael Xufu Huang
Haley Huixuan Liu
Craig Jones
Rebekka Ladewig
Xin Liu
Lisa Messeri
Michael P. Oman-Reagan
Joseph Popper
Lauren Reid
He Renke
Fred Scharmen
Ma Yansong
Zheng Yongchun

We are indebted to Jan Egbers, Yates Norton and Justina Zubė from Six Chairs Books for their invaluable help in making this publication happen

This publication is part of the Lithuanian Pavilion exhibition *Lithuanian Space Agency: Planet of People* at the 17th International Architecture Exhibition, La Biennale di Venezia. The Lithuanian Pavilion is presented by:



Strategic partner:



Partners:

COLLECTIVE



GIOIELLI
NASCOSTI
DI VENEZIA
Fondazione Venezia Servizi



15

Collaborators:

Formuniform

Kosmica Institute

Lithuanian Aerospace Association

Lithuanian Culture Institute

Vilnius Academy of Arts

Vilnius City Municipality

Vilnius Gediminas Technical University

Vilnius Tech, Faculty of Architecture

Vilnius University

For their support in realising and promoting the exhibition, we would like to extend our thanks to our ambassadors and other contributors:

Rasa Antanavičiūtė

Marta Atzeni

Angelo Boscolo

Laura Gabrielaitytė-Kazulėnienė

Lolita Jablonskienė

Vitalija Jasaitė

Giedrė Kasparavičienė

Zehra Begüm Kışla

Eglė Kliučinskaitė

Miglė Kolinytė
Justė Kostikovaite
Maurizio Loi
Monika Mačiulytė
Laure Miedico
Ignas Pavliukevičius
Deividas Rafanavičius
Goda Raibytė
Fred Rodrigues
Giulio Romoli
Marco Scurati
Vladas Suncovas
Giedrė Sileikytė
Linas Šmigelskas
Marius Urbanavičius
Erika Urbelevič
Lina Vaitiekūnaitė
Alessandro Zorzetto
Darius Žakaitis

autoriai | creative agency
Beni culturali Ecclesiastici, Patriarcato di Venezia
Fondazione Servizi Venezia and I.P.A.V.
L'Associazione Culturale Olivolo
Lithuanian Museum of Ethnocosmology
MO Museum

PHOTO CREDITS:

pp. 17-32

© Isora x Lozuraityte Studio for Architecture

p. 85

Embodying Climate Change: Incorporating Full Body Tracking in the Design of an Interactive Rates of Change Greenhouse Gas Simulation - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/Kinect-depth-data-left-joint-skeleton-middle-and-in-simulation-representation_fig2_325801109 [accessed 11 January, 2021]

p. 86

Open Clip Art. Available from: <https://open-clipart.org/de-tail/255328/figure-f-open-acordian-vol-relatif-a-4-formation-skydiving-4way> [accessed 11 January, 2021]

Open Clip Art. Available from: <https://openclipart.org/detail/255336/skydiving-skydiver-para-Chute-vol-relatif-para-chute-parachutisme-com-petition-vol-relatif-vr4-formation-skydiving> [accessed 11 January, 2021]

Open Clip Art. Available from: <https://open-clipart.org/de-tail/255472/figure-j-donut-vol-relatif-a-4-formation-skydiving-4way> [accessed 11 January, 2021]

p. 87

Alessandro Algardi, *Firedog (Juno Controlling the Winds) (chenet) (one of a pair)*
18th century, Bronze, 112.4 cm
Gift of Mr. and Mrs. Charles Wrightsman, 1973.
Photo © Metropolitan Museum of Art
Available from: [https://commons.wikimedia.org/wiki/File:Firedog_\(Jupiter_Victorious_over_the_Titans\)_\(chenet\)_\(one_of_a_pair\)_MET_DP224632.jpg](https://commons.wikimedia.org/wiki/File:Firedog_(Jupiter_Victorious_over_the_Titans)_(chenet)_(one_of_a_pair)_MET_DP224632.jpg) [accessed 11 January, 2021]

- p. 88
Synchro Dolphins, synchronized swimming in Belgium
Colour photograph, 2014
Photo © Kchef. Available from: https://commons.wikimedia.org/wiki/File:Synchro_Dolphins.jpg [accessed 11 January, 2021]

Pixabay. Available from: <https://pixabay.com/photos/gym-girls-rhythmic-gymnastics-512873/> [accessed 11 January, 2021]
- pp. 85, 86, 87, 89, 90, 91, 92, 93, 94, 95
Visuals for *Planet of People* and *Lithuanian Space Agency*, 2018 - 2020. © Studio Pointer*
- pp. 102, 104, 105
© Julijonas Urbonas (Photo: Aistė Valiūtė and Daumantas Plechavičius)
- p. 121
© ESA;
© Lithuanian Space Agency, Julijonas Urbonas, Studio Pointer*
- p. 123
© Xin Liu (Photo: Steve Boxall)
- p. 124
© Xin Liu
- p. 128
© Alamy Stock photo
- pp. 154-155
© MAD Architects

COLOPHON

This book is published in conjunction with the Lithuanian Pavilion exhibition:

Julijonas Urbonas, *Lithuanian Space Agency: Planet of People*
The 17th International Architecture Exhibition, La Biennale di Venezia

Chiesa di Santa Maria dei Derelitti
Barbaria delle Tole, 6691, 30122 Venezia VE, Italy

LITHUANIAN SPACE AGENCY: ANNUAL REPORT NO. 1

Texts by:

Julijonas Urbonas
Michael Clormann
Régine Debatty
Vidas Dobrovoliskas
Hu Fei and Jia Liu
Li Geng
Theodore W. Hall
Craig Jones
Rebekka Ladewig
Xin Liu
Lisa Messeri
Michael P. Oman-Reagan
Joseph Popper
Lauren Reid
He Renke
Fred Scharmen
Ma Yansong
Zheng Yongchun

Graphic essays by:

Isora x Lozuraityte Studio for Architecture
Studio Pointer*

Editor:

Milda Batakytė

Copyediting and proofreading:

Yates Norton

Graphic design:

Studio Pointer* and Jan Egbers

Published by:
Six Chairs Books, Kaunas
RUPERT, Vilnius
Gallery Vartai, Vilnius

Printed by BALTO Print, Vilnius
Edition of 600

Paper: Holmen Book 2.0 60 gsm, Arctic Volume White 90 gsm,
Nautilus Classic 300 gsm

Typefaces: Our Polite Society (OPS) Cubic, Our Polite Society
(OPS) Cubic Italic, Arial, Times New Roman

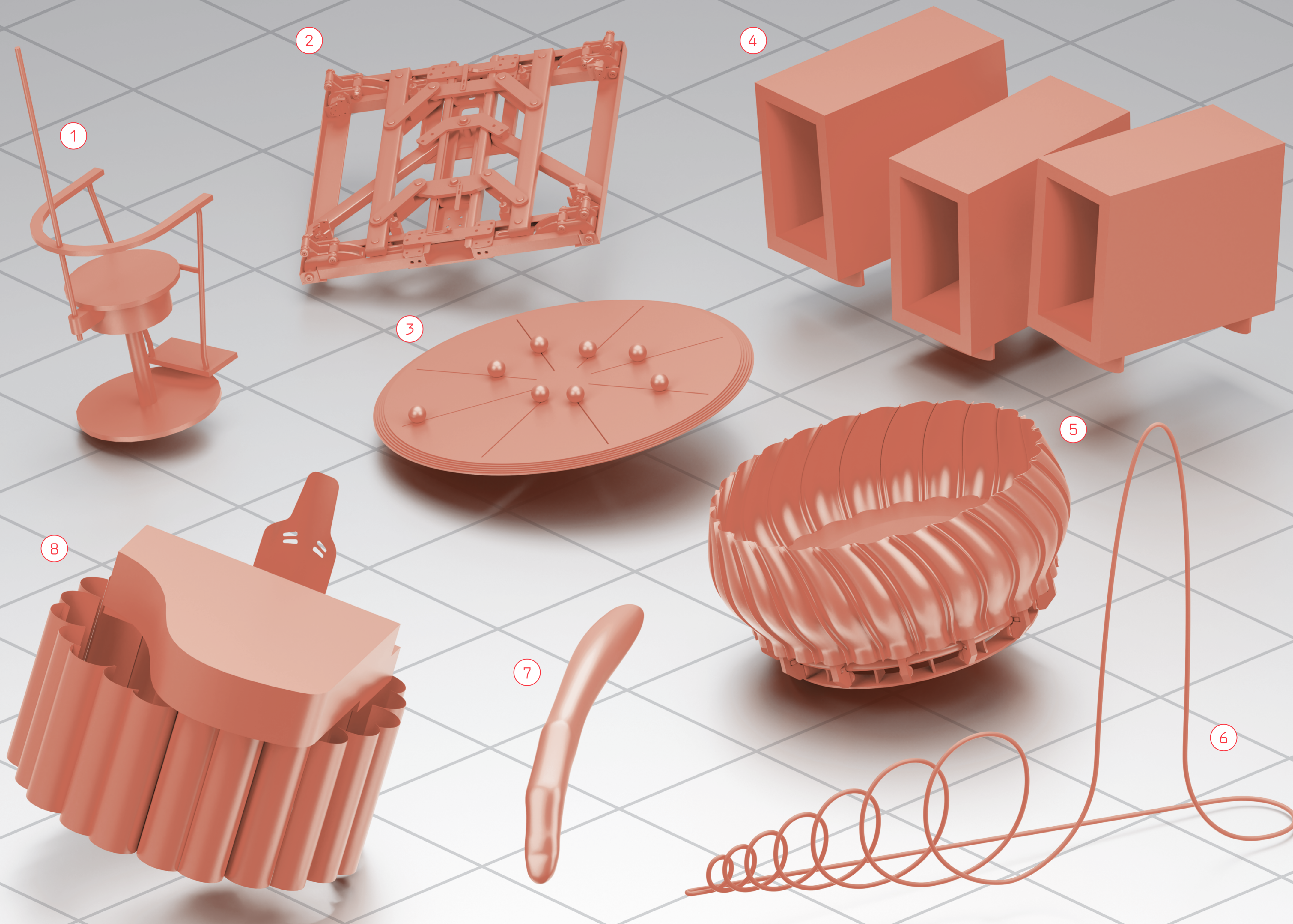
ISBN: 978-609-96058-6-9

©2021 Six Chairs Books, RUPERT, Gallery Vartai

Unless otherwise noted, all images and texts © by individual
artists, authors and their rightsholders.

All rights reserved. No part of this book may be reproduced in
any form by any electronic or mechanical means (including photo-
copying, recording, or information storage and retrieval) with-
out permission in writing from the publishers.

The team thanks all copyright owners for granting permission to
use their material. While every effort has been made to obtain
all necessary permissions and to give proper credits, in the
event of an oversight, please contact info@sixchairsbooks.lt



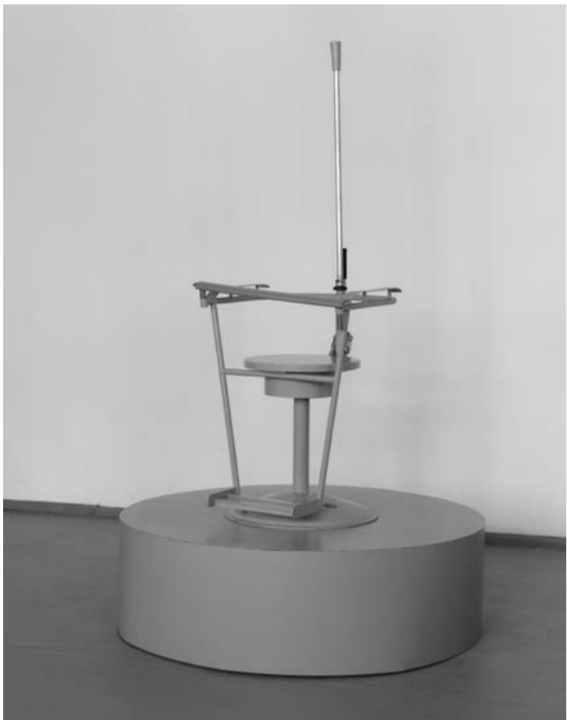
LITHUANIAN SPACE AGENCY: ANNUAL REPORT NO. 1

SELECTED WORKS BY JULIJONAS URBONAS

1 *Barany Chair*

Year: 198? - 2014
Project phase: working lifesize model. Restored.

Barany Chair (named after the Hungarian physiologist Robert Barany) is a device used for aerospace physiological training. One of the key functions of the device is to demonstrate spatial disorientation effects, proving that the vestibular system is not to be trusted in flight. Pilots are taught to rely on their flight instruments instead. It is also used as one of the most effective devices for motion sickness therapy.



In 2014, Urbonas restored a USSR built Barany chair and has been using it as a sort of epistemological engine through which he has communicated his findings in gravitational aesthetics. It has served as an object that he has not only written about but also with. *Barany Chair* has been used for several exhibitions where the public was invited to test the device themselves.

2 *Airtime*

Year: 2016
Project phase: working lifesize model.

Airtime is a kinetic platform placed over a floor designed to deprive an architectural space of gravity. Supported by a custom built hydraulic lift, it moves slowly upwards by one foot and then falls abruptly downwards. The sudden fall suspends everybody in the air for a blink of an eye, creating a sensation of weightlessness.



Airtime is engineered to be easily embedded into almost any room, thereby domesticating zero gravity. Unlike similar technologies such as the ‘drop tower’ thrill ride, *Airtime* does not imprison the body in seats, safety harnesses and other amusement park restrictions, but provides the user with an unrestrained



experience in a space of their choosing. In the technical vocabulary of amusement ride design, the term ‘airtime’ refers to the feeling of weightlessness experienced on a roller coaster or other amusement ride. This effect is achieved either by harnessing upward acceleration or free-fall. *Airtime* is based on the latter method.

3 *Cumspin*

Year: 2015
Project phase: scale model 1:50.

Cumspin is a hypothetical centrifuge based on an amusement ride and is designed to heighten the experience of sexual intercourse. Its core principle is centripetal acceleration, which exposes the riders to variable artificial gravitational forces. This extreme environment provides the users with extraterrestrial sex positions and pushes the peaks of pleasure to a new dimension.



While making love in one of the eight capsules that are spinning on a sixty-meter diameter disc, the lovers may control the centripetal force by changing the distance between their capsule and the spin axis. The farther from the axis, the greater is the force pushing them against the wall and the stronger is the effect of blood flowing in their bodies. During the spin, the riders are ‘pinned’ to the capsule’s spherical, curvilinear walls, which allow for any bodily orientation in space. Therefore, in addition to the change of the capsule’s distance from the axis, the body’s reorientation in space can also choreograph the blood flow. For example, directing blood into and out of the love parts heightens erotic sensations. Directing blood to the lower extremities causes sudden loss of oxygen in the brain and eventually creates a sense of euphoria. Euphoria combined with orgasm provokes a novel form of pleasure, a *hypergravitational orgasm*.

4 *Oneiric Hotel*

Year: 2013
Project phase: working lifesize model.

Oneiric Hotel is an artistic re-enactment of scientific sleep experiments that induced gravitational dreams, during which one could fly, levitate and perform other gravitational activities. The most successful dream-inducing technologies and techniques were selected from sleep labs and transposed as bespoke experiences in the context of a pop-up hotel, ready to be installed in any space. Once put up, the public is invited to take a sleepover or a nap, participating in the dream experiments in their own way.

The hotel package consists of a set of sleep monitoring equipment, dream stimulation devices, special furniture, bedding, air scent, costumes and performative ‘objects’, such as special instructions for the receptionist, a scripted service for sleepovers and others. At the core is the sleep-tracking head-band that detects when the sleeper is dreaming and activates the stimulation devices. These devices include a sleep capsule that automatically rocks during the dreaming state, a set of air cuffs worn on the lower part of the legs that rhythmically squeeze the feet, a voice record player that plays a pre-recorded story in the voice of the dreamer and other similar contraptions.



5 *Cerebral Spinner*

Year: 2020 - under development
Project phase: scale model 1:10.

Cerebral Spinner is a high *g*-force lecture theatre. The machine is a circular structure containing a spinning lecture hall that can accommodate a group of people around its spinning centre. It was conceived to study the effects of heightened gravity upon teaching, learning, thinking and daydreaming.



Under motion, the spinner is capable of ‘pinning’ thirty people to its circular wall due to the centripetal force. The modular wall consists of an array of curvilinear elements, shaped in such a way that, once at full speed, (i.e. under 3 *g*) the riders’ bodies leave the floor, slide upwards and then suspend in midair. The spectacle is clearly visible from any angle as the walls are transparent. This feature facilitates the observation of the effects upon the subjects of the experiment.

6 *Euthanasia Coaster*

Year: 2010
Project phase: scale model 1:500.

Euthanasia Coaster is a hypothetic roller coaster, engineered to take the life of a human being with elegance and euphoria. As the rider moves through the seven loops of the coaster, they are subjected to a series of intensive motions that induce an arc of unique experiences: from euphoria to thrill, from tunnel vision to loss of consciousness and eventually death. This is due to prolonged exposure to overwhelming gravitational forces that cause cerebral hypoxia or the insufficient supply of oxygen to the brain that is widely considered as the most pleasant way to die.



The roller coaster begins with a two-minute ride up a steep-angled incline to the 510-metre (1,670 ft) high peak. From there, a 500-metre (1,600 ft) drop would take the train’s speed to around 360 km/h (220 mph), which is close to its terminal velocity. The coaster then flattens out before looping into seven slightly tear-drop or clothoid shaped inversions. As the train loses speed, each inversion has a smaller diameter than the one before in order to maintain the 10 *g* force required to make the trip lethal, while also counteracting any unappealing physical damage.

7 *Emetic Spatula* (from *Emancipation Kit*)

Year: 2009
Project phase: working lifesize model.

Emetic Spatula is an ergonomic vomit-inducing tool. The titanium stick is medically engineered to easily and comfortably stimulate the constrictor muscle that

can provoke vomiting. This muscle is located deep in the throat behind the dangling bit of tissue called uvula, which is difficult to reach with a bare finger.

The tool is used by placing the tip of the stick into the throat and gently moving it around to create a tickling experience. Once the heaving starts, it is recommended that one removes the spatula from one’s mouth. However, even without taking the tool out, the hydrodynamic shape of the tool will still allow the safe passage of the liquids out of the mouth. Such a design guarantees the eviction of contents of your stomach in a controlled and elegant manner.



The object celebrates the human victory against gravity, which comes at the cost of airsickness.

8 *Hypergravitational Piano*

Year: 2018
Project phase: working lifesize model.

Hypergravitational Piano is a hybrid centrifuge that includes a grand piano and a piano player. The machine was developed to study the effects of altered gravity on the player, the instrument and the sound and music. Capable of producing 3 *g* (three times higher than that of Earth’s gravity), the centrifuge becomes a hypergravitational soundstage. In addition to this, the centrifugal force of spinning produces unique gravitational fields that vary at different points in relation to both the player and the piano. The force increases further away from the spin axis. Thus, the fingers on the keyboard, for example, feel a weaker pull than the head or the back. Furthermore, the movement of the playing hands are affected by the complex Coriolis forces as are the piano strings. The constantly changing orientation of the instrument affects the way the sound is transmitted. All of these unique physical and mental conditions give birth to what can be called an extraterrestrial sound.



Initially, Urbonas developed this work to produce a soundtrack to accompany the project *Planet of People* while also staging a thought experiment about extraterrestrial sound.

The Lithuanian composer Gailė Gričiūtė composed a piano piece specially for whenever *Hypergravitational Piano* is displayed.

Image credits:

Hypergravitational Piano, *Euthanasia Coaster*, *Cumspin*, *Cerebral Spinner*, *Airtime*. © Julijonas Urbonas (photos by Aistė Valiūtė & Daumantas Plechavičius)
Barany Chair. © Julijonas Urbonas
Emetic Spatula. © Julijonas Urbonas (photo by Delfino Legnani)