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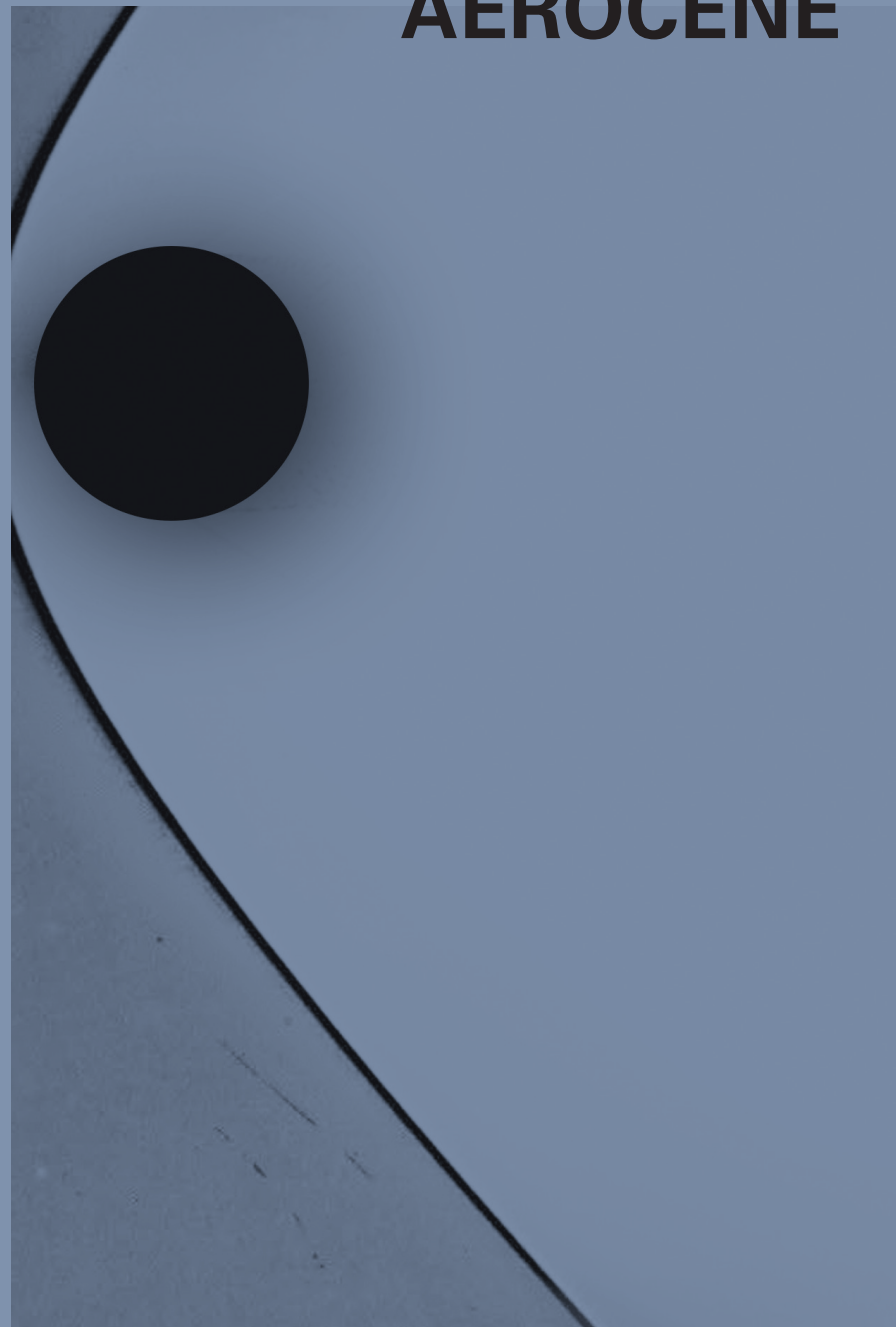
Derek McCormack

London 2016

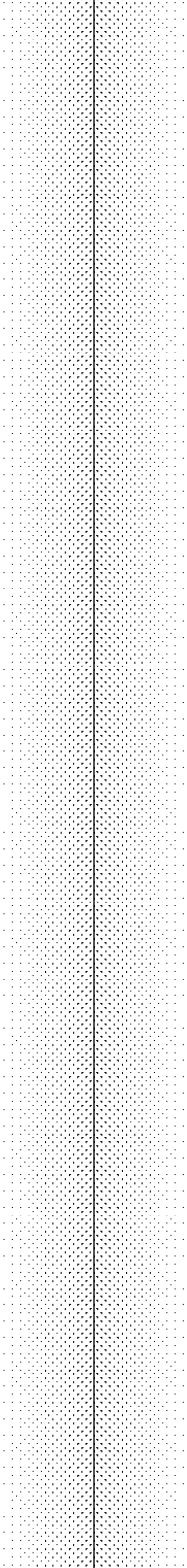
London 2016

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# AEROCENE



EXHIBITION ROAD



Inflated only by air, lifted only by  
the sun, carried only by the wind,  
towards clean and sustainable  
futures.

**“Aerocene is a project about friendship, about the relationship between air, universe, humans, sun, animals, plants, planets. It is a project showing how shared enthusiasm becomes the common ground to shared dreams. Where time becomes different, where energy and inspiration are endless resources. I can only hope that this family will grow even bigger.”** Tomás Saraceno

Aerocene is a multi-disciplinary project that proposes a new epoch. In the wake of the debates on the Anthropocene, the project foregrounds the artistic and scientific exploration of environmental issues, and promotes common links between social, mental, and physical ecologies. A synthesis of art, technology and environmental awareness, Aerocene embodies a vision for fossil- and emissions-free travelling and living in the atmosphere.

Aerocene increases public awareness of global resource circulation, and reactivates a common imaginary towards new ways of co-inhabiting the earth.

Its activities manifest in the development and testing of aerosolar balloons, in the distribution of open-source flying kits (the Aerocene Explorer) and in the organization of exhibitions, discussions, and publications with an ever-growing global community.

## Aerocene at Exhibition Road

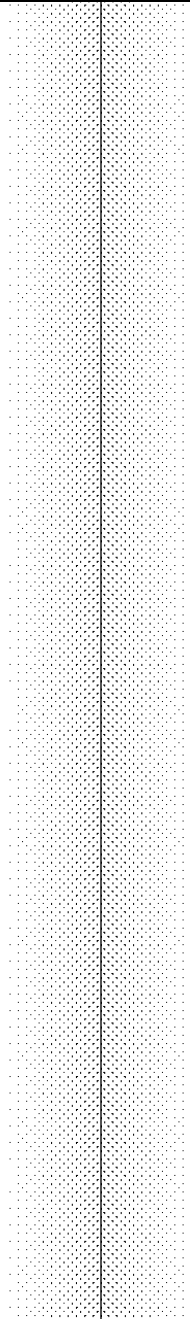
In 2016 the Aerocene Foundation was invited to Exhibition Road for an interdisciplinary artistic project co-produced by members of the Exhibition Road Cultural Group: a partnership of the leading cultural and educational institutions in London, among them Serpentine Galleries, Imperial College London and The Natural History Museum. Between October and December 2016, the Aerocene Foundation activated a collaborative research platform between Exhibition Road members and wider communities by organizing two hackathons and the 'Aerocene Campus' in which participants engaged in debates on metabolic, social and environmental dimensions of the Aerocene epoch.

During this period, experts as well as developers, designers, artists, data scientists, creative technologists, atmospheric scientists, musicians, engineers, social scientists and geographers gathered to develop the conceptual and practical framework of Aerocene's methods in order to support fundamental research on several key areas: the diversity of life in the air, the collection of cosmic material, the sensory and sonic exploration of the atmosphere and multispecies encounters in the rainforest. Participants were asked to prototype innovative user scenarios for Aerocene flights, including mashups with other data sources, to develop the technology able to locate the position of Aerocene Explorer's landing, to forecast the Aerocene Explorer's trajectories, and to study the principles of biostratigraphy in order to understand (and in turn, create) more equitable and sustainable futures.

By sharing across artistic and scientific practices, debating the meaning of

geographical exploration today, and investigating how exploratory journeys can become sensitive to the physical and spatial—as well as humanistic and creative—expressions of our planet and its cultures. Aerocene's manifestations at Exhibition Road open up ways of approaching and combining different disciplines, and create an intellectual frame to inspire independence from fossil fuels.

These vibrant engagements have demonstrated how community-driven practices with the Aerocene Explorer can inform environmental, social and mental ecologies in post-Anthropocenic worlds, while co-creating the Aerocene epoch.



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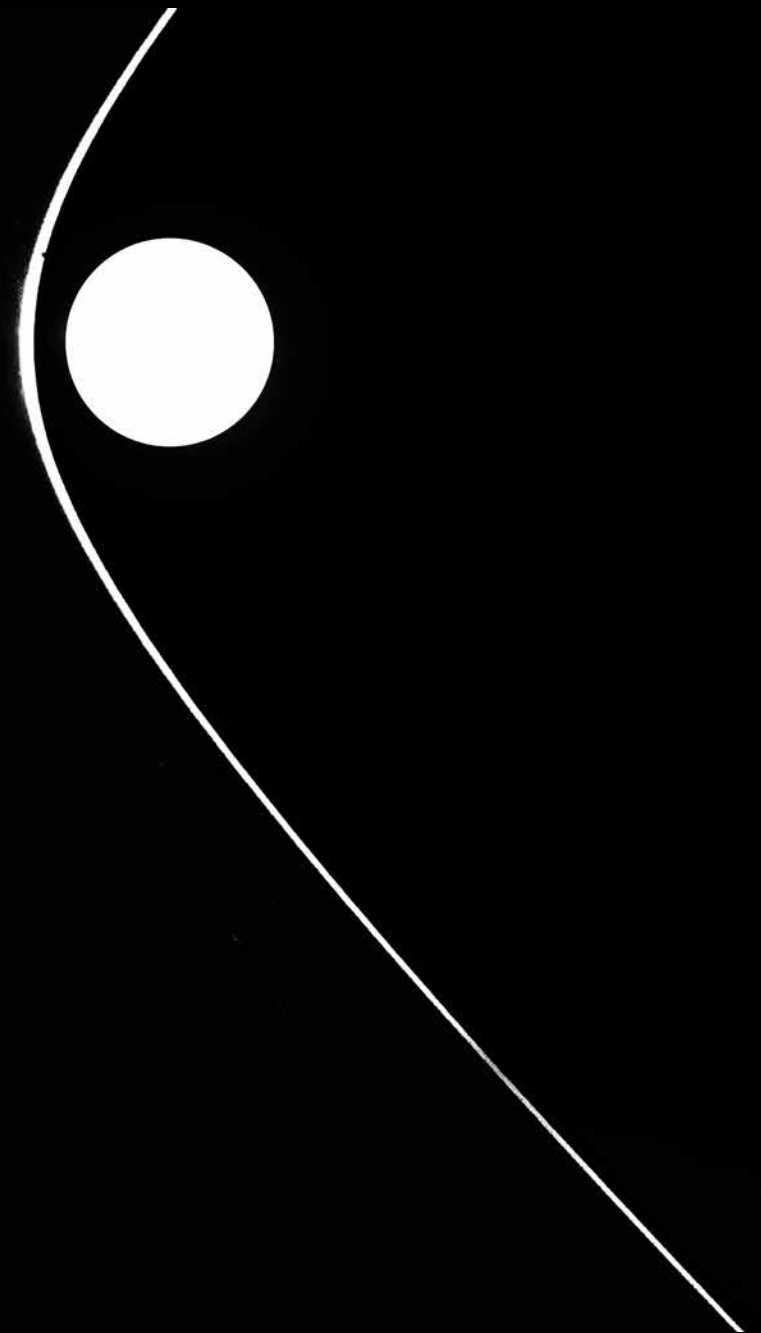
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Colophon



# Floating above Exhibition Road:

## *A Prelude*

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Carlo Rizzo

Alex and I are making our own air-filled sculpture. With tape, scissors and plastic bags. It's a pyramid, more or less. 'Can I go in it?' he asks. 'We must make it bigger, then', I say.

Before imagination there is air. It gets in, it gets warm with the sun, it goes up. Then it's up to the wind, and a string, if we really want to keep hold of it. Otherwise we could let it go and chase it on its way to countries and cities we can try to predict. We definitely need a good knot, to keep the air in and the filling intact. And to patch up the holes we made running on it, after scattering paint on the sides. 'I made a rocket!' he shouts. The flames are green and yellow and blue. Before air there is imagination, I figure.

The first time I thought about inviting an artist to work with our Exhibition Road institutions I remember looking at air. The large mass of air above the road, the invisible common space that we take for granted and that connects us all somehow. There were talks of 'Public Art'. I used to get this question a lot: 'Where will the sculptures be?' 'Anywhere.



They might even float above your head', was my standard reply. I didn't know about Aerocene at the time, but I knew we spent so much time looking down.

I knew that behind the walls, in the labs and the halls, offices and exhibition rooms, there were so many stories to tell. This is the oldest cultural quarter in the world after all. It was built, bombed, demolished and rebuilt, expanded and beautified throughout the last century and a half. There was a common vision at the start: to bring art and science together at the service of progress. It is still the case. I was hoping for this idea to show me the way somehow.

Utopias have been in fashion in the last few years. They must really feel real at that junction of hope and fear. Then there are those who use imagination to change things today, tomorrow. With friends and colleagues I discussed this a lot, and in the end we thought: this is what we should bring here, an idea that can show us the way to a possible future, not a distant one.

Aerocene is the idea. It changes the way we live, move, and relate to the natural world. It celebrates the wisdom of other species and injects a healthy dose of humility in our own species. It connects. Here it brought together composers, geographers, climate scientists, aeronautical engineers, biologists, designers and more. It offered inspiration to school children and PhD students alike. It created new bridges by offering a common language.

A common language is what I hope will be its legacy. We wanted to show that it could be built across disciplines, without hierarchies. We wanted to show that these new bridges can advance knowledge further and in new directions. And that art has the power to initiate that process like nothing else.

I hope we succeeded.



**Aerocene Workshop, Epic CIC  
Flashpoint Youth Centre, Worlds  
End Estate, London, June 2017.**

# To Aerocene:

## *An Introduction*

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Sasha Engelmann

Benjamin, Walter. '.\*' *In Reflections: Essays, Aphorisms, Autobiographical Writings*, Schocken, 1986.

***Man can be in ecstatic contact with the cosmos only communally.***

Thus wrote Walter Benjamin in *To the Planetarium*, a text that calls for the end of the species of Man, and the beginning of mankind: a new species whose *wooing of the cosmos* would not bend to the lust for profit or the mastery of nature. Is such cosmic contact truly possible for mankind?

Benjamin answers: 'One need recall only the experience of velocities by virtue of which mankind is now preparing to embark on incalculable journeys into the interior of time, to encounter there rhythms from which the sick shall draw breath'. This comingling with cosmic powers, this trance-like breath, exceeds individual experience.

It is only attained communally. Yet it also exceeds Benjamin's planetarium, and the frames of thought on which it depends.

**\* *One need only recall the experience of velocities.***

The velocity of a fragile, sun-warmed, air-filled entity taking flight. The velocity of a room filled with bodies in tense relation, with strange and alluring instruments, with breathless speeds of thought, with friends, family and kin.

Here in this room, this alter-planetary, we encountered the cosmos communally. We encountered *free flight*: the proposition of far-flung untethered journeys borne only on sun and wind. We met *life in the air*: the promise of new species-kin who live in the gases and high currents above us. And we also encountered *atmospheric soundings*: those echoes, pulses and beacons of extra-earthly origin, transmitted to us in our humble, grounded state. These encounters were part of a day-long event—the Aerocene Campus—in which we

grasped new ways of being, thinking and doing in the cosmos, in the air, and on Earth.

### ***To Aerocene.***

This text and those that follow are the propagation patterns of the Aerocene Campus and several other Aerocene experiments that took place on Exhibition Road, London in Autumn 2016. The words collected in these pages mingled first in breath, and they mingle here in line, shape and image. Artists, scientists, sociologists, geographers, philosophers, designers and programmers are among those who share propositions. An eclectic constellation, to be sure. The words and images here resonate with the uniqueness of their author(s). But equally, they shimmer with the particular communal challenge of days spent inventing, mapping and imagining the Aerocene epoch on Exhibition Road.

**\* *What is nearest to us and what is remotest...***

The images, diagrams and texts in these pages entangle the nearest-remotest: the very near and far away. The challenges are many: how to hold the paroxysm of Aerocene together with contemporary politics, habits and laws? How to bend the very far away of academic language closer to the logic of the programmer and the poetics of the artist? How to maintain the generosity needed for such adventures? These questions troubled us in our alter-planetarium. They troubled but they also moved us, bodily and intellectually, to risk more of ourselves.

**\* *A physis is being organized.***

If there is a common *physis* in the materials in this book, it is the degree to which an uplift can be felt: a flight

McCormack, Derek. 'The Promise of Release' (this volume) 2017.

Szerszynski, Bronislaw. 'Aerocene and the Mobility Paradigms of the Earth' (this volume) 2017.

of fancy, a levitation, a promise of release, a swift wind, a drift paradigm. Icarus-in-a-flat-pack. Airborne pollen spores. Aerosolar forecasts. There are uplifts in voice. And there are uplifts, too, in the experiments of students, scientists and citizens who participated in the 'hackathons' that animated the Aerocene in London. These uplifts are part of the *physis* of the Aerocene in the way that Aerocene itself is an uplift, as Bronislaw Szerszynski writes, 'in the continuing, evolving story of the planet and its powers.'

**\* *A portent of what [is] to come.***

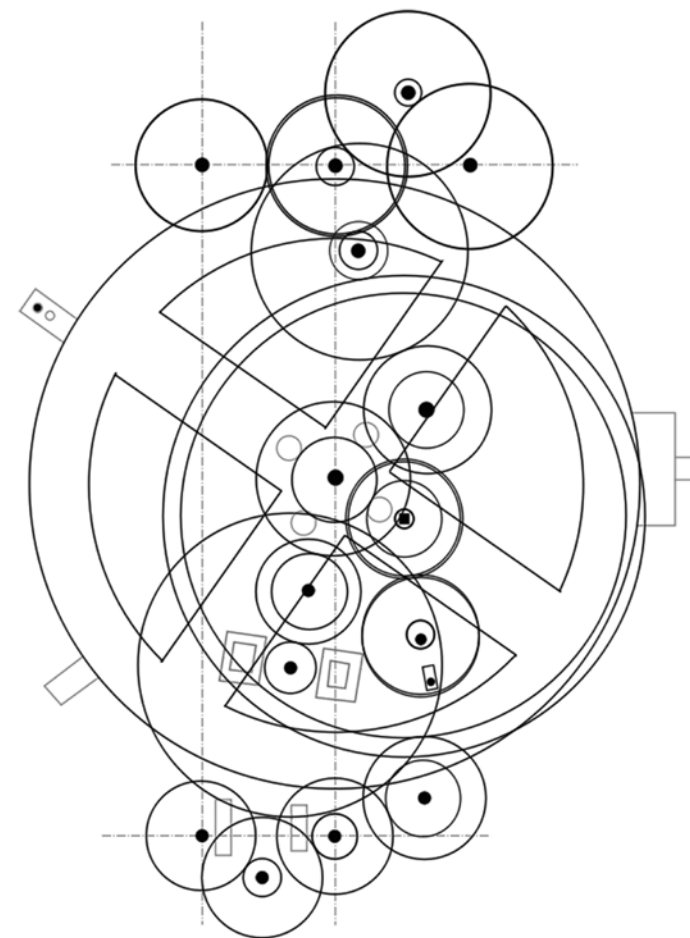
A secret garden launch site. A lure to the future. According to Derek McCormack, Aerocene's gestures of uplift produce 'new spheres of involvement in orbit around important matters of political, social, or cultural concern.' In other words: they produce a different

planetarium, one whose theories, paroxysms and rhythms are nearest and remotest, at the same time. Indeed, the Aerocene that echoes in these pages is the task of a new, lucky species: one that *attains ecstatic contact with the cosmos, communally.*

\* Excerpts from Walter Benjamin's '*To the Planetarium*'



Michel de Ma-rolles, *Tableaux du Temple des Muses*, plate 25, Paris, 1655. The plate carries an inscription in Latin from Homer, *Odyssey* Bk 11 that refers to the conjoined fate of the Dioscuri, also known as the Gemini, as they traverse the heavens. Photo Warburg Institute. Courtesy of the Warburg Institute.



**A schematic for the Antikythera mechanism: an ancient Greek analogue computer and planetarium used to predict astronomical positions and eclipses for calendrical and astrological purposes.** The artefact was recovered on May 17, 1901 from the Antikythera shipwreck off the Greek island of Antikythera, which in antiquity was known as Aigila. Believed to have been designed and constructed by Greek scientists, the instrument has been variously dated to about 87 BC.

# Flights of Fancy

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Harriet Hawkins

Adey, Peter. 2014. *Air: Nature, Culture*. Chicago and London: University of Chicago Press.

Adey, Peter. 2010. *Ariel Life: Spaces, Mobilities, Affects*. London: Wiley-Blackwell.

To think of flights of fancy is perhaps to conjure up aerated puffs of preoccupation, superfluous expenditures of energy that delight the mind with intellectual dalliances that fail to live up to the grounded nature of more solid strata of thought and action. Yet folded within the phrase is also the power of the imagination, the sense of being set free to think, of allowing the mind to expand untethered toward unforeseen futures and unknown territories. For, to even think of flying, to even ponder the possibilities of becoming airborne, is a powerful thing. Centuries of aesthetics and imaginaries of flight have activated air as both a space of and a medium for social, political, and intellectual practices (see for example Adey 2010 and Adey 2014).

Beginning from this idea, I am interested in how acts of ascension—real or imagined—might open up diverse new intellectual and social territories. This goes as much for those who partake in the Aerocene through launching solar sculptures as for those for whom the Aerocene opens

up imaginative territories just through entertaining the possibilities of such flights. Embracing flights of fancy in the affirmative I am interested in how free flight in the Aerocene opens up spaces and practices of imaginative possibility. Two sites enable me to elaborate on these ideas:

1

Mt Chimborazo, Ecuador in 1802 where, ascending to the princely height of just over 19200 ft, Alexander Von Humboldt and his companion Emile Bonpland climbed higher than any European man had before them or would for the following 30 years. Theirs was a scientific mission however, and new heights demanded novel apparatus. Evolving his ways of knowing as he ascended, Humboldt's instruments of science fell short and he turned to his body as a sensory apparatus. He became known for his

Wulf, Andrea. 2015. *The Invention of Nature*. London: John Murray.

Walls, L.D. 2009. *The Passage to Cosmos: Alexander Von Humboldt and the Shaping of America*. Chicago and London: University Chicago Press.

corporeal calibrations that enabled amongst other things, the tracking and recording of the colour of the sky, the plotting of vegetation types and the tracing of the effects of altitude (see Wulf, 2015 for a very readable account of Humboldt's life, explorations and impacts; see also Walls, 2009). It is often Humboldt's reflection on 'the higher point of view' that Chimborazo afforded him that is seen as the locus for his re-visioning of nature as an interconnected living whole.

Perhaps though it was less the lofty pinnacles Humboldt reached and rather the very process of ascension and the experiments it involved that shaped not only his new imaginaries of nature but also the very practices of Enlightenment science itself. Humboldt's heights were however, not reached without significant political costs. His was an Imperial science, and as such an ascension predicated on troubling intersections of power-knowledge. It was an overview that



was to cost the indigenous inhabitant of those places he overlooked dearly.

If we might learn to value experimental ascensions, we might also, taking heed from Humboldt remain alert to the politics of Aerocene's flights of fancy. We might wish to query who participates and how in these flights, and we might continue to direct our attention to refining the Aerocene's democratic, open-source, participatory possibilities, rerouting these intersections of science—expertise—power to ensure we remain open to the possibilities of other politics of ascension.

2

It is 1966 and the Armory Show is taking New York by storm, and Jasia Reichardt, then associate director of the fledgling London ICA, meets Billy Kluver one of the founders of

Breitweiser, Sabine., ed. 2015. *EAT: Experiments in Art and Technology*. Berlin: Verlag der Buchhandlung Walther König.

'Experiments in Art and Technology' (E.A.T.). She watches as he negotiates relationships between artists and engineers from Boeing and Bell, admiring how he managed 'artists who wanted engineers to do the impossible—artists who wanted to fly' (see accounts of E.A.T in Breitweiser, 2015 for further discussions).

Flight here evokes the limits and extent of artistic ambition, an ambition in the service of which interdisciplinary communities of practice are assembled to expand and test and push the limits of knowledge. Bringing together thousands of artists, engineers, and scientists in an international network that included representatives from Boeing and Bell, E.A.T created interdisciplinary communities of practice bent on problem solving. Oftentimes it seems that the posing of challenges and the assembling of these innovative interdisciplinary communities was the point of the

practice; if many of the finished outcomes have been lost, the accounts of lively meetings and experimental makings remain.

Some 50 years later and flight is, in an Aerocene context, once more a point of interdisciplinary assembling. Individuals come together to make, do, debate and imagine, drawn in by who knows what, compelled to stay perhaps by the intrigue and possibilities that abound in the Aerocene's compelling possibilities of futures collectively made otherwise.

Perhaps, just perhaps, what is important here is less the solution that is sought, less whether the Aerocene Explorer is able to do what it sets out to do, and rather what should be foregrounded as what happens in the collective processes of doing, thinking, and imagining flight.

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Dialogues across disciplines, practices, and centuries link, not without some productive critical torsions, Alexander Von Humboldt in the eighteenth century, mid-twentieth century American experimenters and the Aerocene Explorer. What do we learn from these connections? That flights of fancy offer openings out of the imagination, they present possibilities for experimental ascensions untethered by existing apparatus or sedimented ways of knowing or being, and that exceeding vertically posed limit points can demand interdisciplinary—maybe even democratic—solutions.

Taking flight with Tomás and his team encourages us to query what new forms of sensory apparatus Aerocene ascensions demand and what new forms of sensing they make possible. We are required to reframe our views, to query what measuring and recording from such lofty outlooks does to our earthly thinking, and to reflect on how the overview

gained from on-high should, by necessity, be one that assembles the views and practices of the many—of citizen scientists and local experts—rather than foregrounding the rarefied knowledge practices of the few. Finally, in the currents of possibility and updrafts of the imagination inspired by these Aerocene practices, our own ways of knowing and doing become un-tethered, carried up toward and even beyond our own limits—individual or disciplinary—as we seek out our own Aerocene flights of fancy.



fig. 1



fig. 2



fig. 3



fig. 4



fig. 5



fig. 6



fig. 10



fig. 9



fig. 7

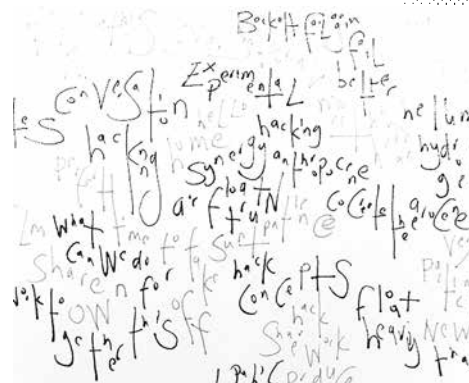


fig. 8

fig. 1 Eduard Ender, Alexander von Humboldt and Aimé Bonpland in the Amazon jungle, 1850. Oil painting exhibited at Berlin-Brandenburgische Akademie der Wissenschaften.

fig. 2 Alexander von Humboldt, Distribution of Plants in Equinoctial America, According to Elevation Above the Level of the Sea. 1839.

fig. 3 9 Evenings: Theatre and Engineering, announcement for a series of performances from October 13–23, New Jersey, 1966.

fig. 4 Hans Groß, Humboldt's Crash on March 14, 1893.

fig. 5,6 Fog Sculpture by artist Fujiko Nakaya at Pepsi Pavilion at Expo '70 in Osaka, 1970. Nakaya was the Tokyo representative for Experiments in Art and Technology (E.A.T.).

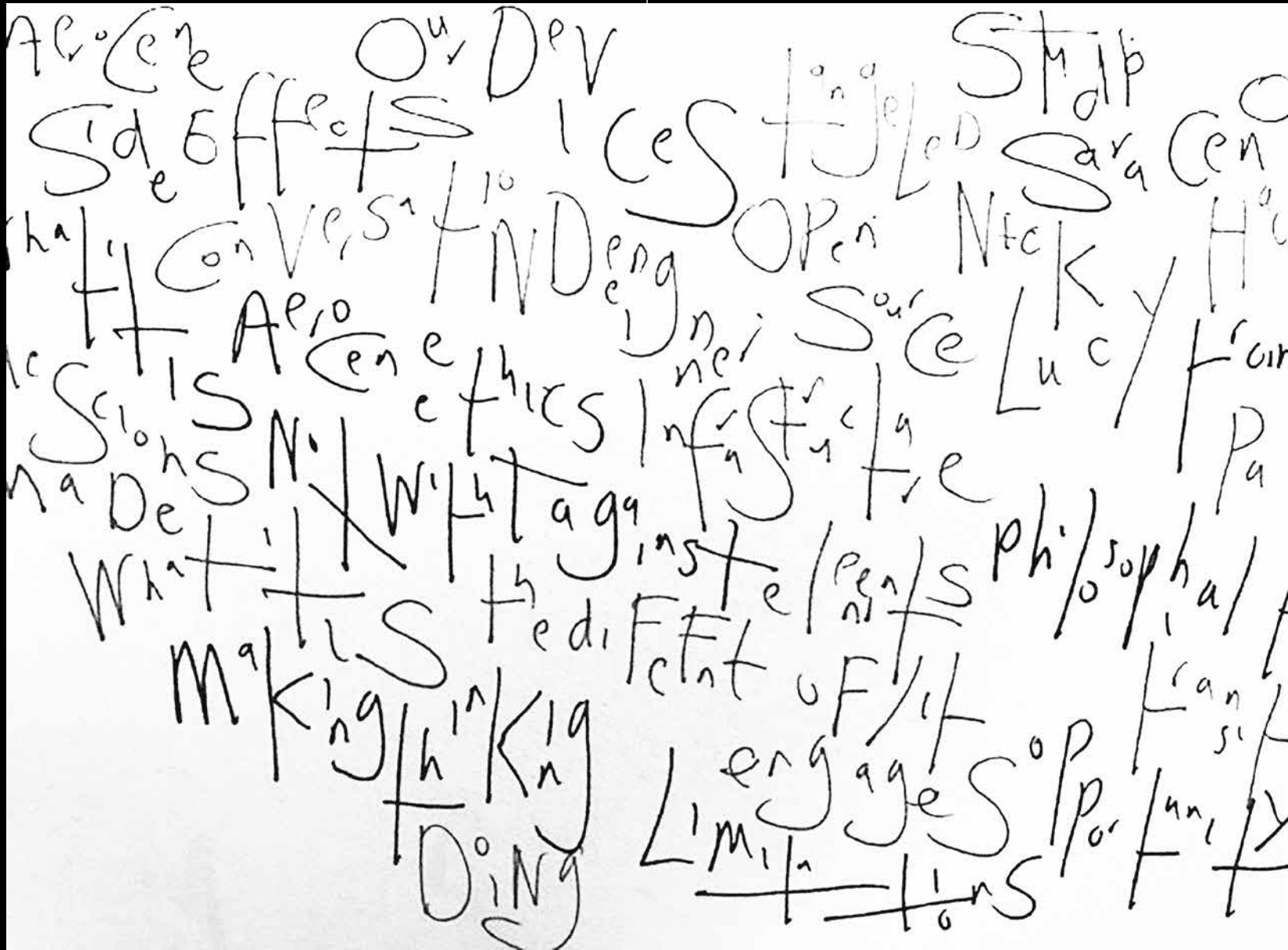
fig. 7 Inside the Mirror Dome, the reflection of the floor and visitors hangs upside down in space. Pepsi Pavilion at Expo '70 in Osaka, 1970 developed by E.A.T.

fig. 8 Harriet Hawkins, Word Bubbles drawn while in conversation with Tomás Saraceno, Ignas Petronis, Sasha Engelmann, Carlo Rizzo and Karina Pragnell on Exhibition Road, London, 2017.

fig. 9 Letterhead for Experiments in Art and Technology (E.A.T.). E.A.T. was a non-profit and tax-exempt organization established to develop collaborations between artists and engineers.

fig. 10 Merce Cunningham Dance Company, Variations V, ballet in Hamburg, Germany, 1966. From left to right, John Cage (composer), David Tudor (composer), at the bottom Barbara Lloyd, to the right Gordon Muma (composer).

fig. 11 Harriet Hawkins, Word Bubbles drawn while in conversation with Tomás Saraceno, Ignas Petronis, Sasha Engelmann, Carlo Rizzo and Karina Pragnell on Exhibition Road, London, 2017.



Harriet Hawkins, Word Bubbles drawn while in conversation with Tomás Saraceno, Ignas Petronis,

# Aerocene and the Mobility Paradigms of the Earth

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Bronislaw Szerszynski

Tomás Saraceno's 'Aerocene' is an alternative, hopeful vision for the new epoch of the Earth into which we are moving, one in which the human being takes flight—imaginatively, vicariously, physically—into the flow of atmospheric currents, using craft powered only by the warmth of the sun. In this article I want to explore how the Aerocene might fit into the wider operating of the Earth system and its ongoing development, based on a wider analysis of *how things move* within the Earth's extended body of rock, soil, water and air.

Over its 4.5 billion year history, the Earth has produced a wide diversity of kinds of motion amongst its constituent parts (Haff 2010; Szerszynski 2016a). However, for a complex set of reasons—a combination of natural physical laws, the composition and size of the earth, and particular contingent developments in Earth history—these kinds of motion, whether involving living or inanimate entities, have come to cluster

into a handful of ‘paradigms’ or ‘regimes’. By situating the Aerocene in this evolving anatomy of Earthly mobilities, we can get a better sense of its potential significance for the planet.

### Identifying mobility paradigms

Given the huge range of kinds of motion in the Earth, how would one go about distilling all of these down to a few paradigms, especially without falling back on existing categorisations of Earthly entities? We can start by taking a wide range of moving entities and asking in turn four questions about them. Note that here by ‘moving entity’ I mean an *entity-in-motion*, in the sense that its motion—and also how this relates to the environment through which it moves—is in some sense as much a part of what makes it that kind of entity as its physical makeup (think of wind or rain for example). So firstly we can ask of our moving entities the question of *geometry*: when the entity moves, how do the

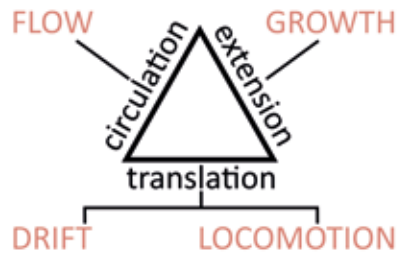
Lafitte, Jacques. 1972. *Réflexions sur la Science des Machines*. Paris: Vrin.

different parts of it move in relation to each other and to the overall movement? Secondly, we can ask the question of *mechanology* (a term I take from Jacques Lafitte ([1932] 1972)): how does the motion of these entities involve interaction with the surrounding environment and its arrangement of matter and forces? Then, thirdly, there is the question of *energetics*: from where in the Earth system does this kind of motion get its energy?

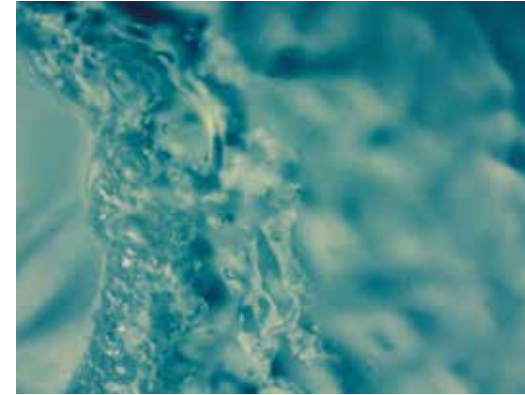
And fourthly there is the question of *function*: what role does this motion play within wider systems within the Earth? In order to identify mobility paradigms, we can see whether, across different moving entities, the answers to these questions tend to cluster, and how.

I would suggest that, in general, the answers to each of these four questions do indeed cluster, and in a broadly compatible way (although as we move down the list of questions this correlation becomes increasingly contingent,

and might therefore be very different on other planets, and on our own at different times in its development). They point to the existence of four major paradigms of Earthly mobility:



These four paradigms are neither exhaustive nor exclusive: some moving entities will share features of more than one paradigm, while some might not fall properly within any of them. Within each paradigm one can also distinguish different zones, clusterings or sub-paradigms. But I want to suggest that these four are the dominant 'basins of attraction' within the huge 'phase space' of the different ways in which things move in the extended body of the Earth. Let me now summarise them a little less briefly.







The **FLOW** paradigm is characterised by the motion of fluids—either liquid or gas—when driven by applied gradients. Flow is paradigmatically circulation *within* a body of fluid (such as the atmosphere and oceans), where applied density and pressure gradients produce forces that make the different parts of the fluid move in a constant attempt to achieve equilibrium, and then thereby typically generate new gradients and new forms of motion. But flow can also sometimes extend the body of the fluid in space (such as when a river bursts its banks), and here this paradigm echoes features of the GROWTH paradigm below. As well as proper fluids, collections of discretised solid objects can also exhibit what is called ‘granular’ flow (such as in landslides and avalanches).



In the **GROWTH** paradigm bodies are not moved but extended in space, such as when a tree branch grows towards the light. I am calling it ‘growth’ for brevity,

but here we are not so interested in the simple expansion of size in all directions, or in 'stretching'; in this paradigm growth is achieved not by moving the constituent parts in the direction of travel (although within and between these parts there may be flow and other sorts of motion), but by adding new ones at the extremities.

The **DRIFT** paradigm is characterised by solid particles being moved by ambient gradients in fluid media. Central to this paradigm is the entrainment, transport and deposition of particles by moving fluids such as wind and rivers, but it also includes particles being moved by gravity, for example down slopes; indeed, crucial to this kind of motion is a balance of forces between gravity and other forces that are internal to the fluid such as those from pressure differentials and viscosity. Despite the language of passivity, and its dependency on FLOW, the DRIFT paradigm constitutes a different kind of motion with its own distinctive properties:

it is only in cases of DRIFT that we might talk about things being 'picked up', 'carried', 'sorted' and 'delivered'.

Finally, in the **LOCOMOTION** paradigm, solid bodies, generally complex in composition, use on-board power to actively transport themselves in directions that might be against local energy gradients such as gravity or flow. Central to this paradigm are animals with their ability to absorb and store energy and then use it to power limbs to produce directed motion, but human-made powered vehicles constitute another growing set of participants in this form of motion.

### **Assigning moving entities to the paradigms**

Now we have used the questions of geometry, mechanology and energetics to identify and define our mobility paradigms, and have identified a few of their more

typical examples, how would we go about assigning other moving entities to these paradigms? Here the first two questions are the most fundamental.

The question of *geometry* is crucial for deciding whether entities belong to one or other of the first two paradigms, or to the second pair. FLOW in principle involves the constant motion of all parts within the boundary of the fluid body, down to the level of individual molecules. GROWTH involves little or no movement of individual parts within the boundary of the entity, but instead the adding on of parts at its periphery. DRIFT and LOCOMOTION by contrast both involve 'translation', a geometrical term referring to any kind of movement where all the points within the moving entity move broadly in parallel.

In order to distinguish the DRIFT and LOCOMOTION paradigms we are better moving to the second question, that of

*mechanology*. We can start to see whether a given moving entity is the natural denizen of one paradigm or another by looking at its shape, and asking what clues the shape gives us about the relationship that the moving entity takes up with its surrounding medium. What does its outline and peripheral features (shape, smoothness, extremities, articulation) suggest about the way that its body might channel and transform the energy, forces and arrangement of its environment as it moves? Is it radially symmetrical when seen from above (implying moving with the flow)? *Probably DRIFT*. Does it have extremities, such as fins, wings, propellers, legs or wheels that can transmit power and accelerate the entity independently of local gradients? *Looks like LOCOMOTION*.

There are also further questions which won't necessarily tell us whether the entity belongs to DRIFT or LOCOMOTION, but would nevertheless help us to position it within different mechanological zones

within either of those paradigms. For example, is it large or small, and how might its size and shape affect the balance of forces around it as it moves? Does its shape suggest that it has ways of gaining and maintaining a particular orientation and direction during motion?

## The evolution, energetics and functions of the mobility paradigms

Let us now look at how these kinds of motion fit into the story of the evolving Earth system, how are they powered, and what wider functions they might serve. There is a rough order of establishment of the four mobility paradigms in the Earth's history, with two becoming significant early on and two more recently. Here the pairing is different than in the previous section: FLOW and DRIFT first, then GROWTH and LOCOMOTION later, because of the way that in the Earth at least the latter two have depended on

Blacktin, S. Cyril. 1934. *Dust*. London: Vol. Chapman & Hall.

Szerszynski, Bronislaw. 2016(a). *Planetary mobilities: movement, memory and emergence in the body of the Earth*. *Mobilities* 11, no. 4: 614–28.

the presence of living things. The FLOW paradigm would have been the first to be established, as the gravitational collapse of the planet from the solar nebula and subsequent processes of planetary differentiation created conditions for fluid motion in the mantle below the terrestrial surface and in the atmosphere and hydrosphere above it (Szerszynski 2016a).

The DRIFT paradigm would then quickly have emerged due to a combination of factors: first below the surface, the differentiation of the planet into liquid mantle and floating crust plates, and then above the surface, as the slow rain of falling cosmic dust was increasingly joined first by particles emitted from the depths of the planet by volcanic eruptions and then by those separating from the cooling rocky surface due to weathering and erosion (Blacktin 1934).

The other two paradigms really become significant only in the last half a billion years, with the emergence of

complex life. The GROWTH paradigm occurs in the mineral world—sedimentary rocks, and the growth of crystals and other chemical deposits in liquid media—but has been developed to its greatest sophistication by plants and fungi, especially in the space-filling growth that involves adding new cells at the end of the roots and stems of plants and the hyphae of fungi. But the spread of biotic ‘aggregates’ such as ecosystems and animal societies across the terrestrial surface (Simpson 2011) constitutes a form of GROWTH which is laid on top of other forms of motion amongst individual members. Finally, LOCOMOTION really only becomes significant in the Earth with the emergence of animals, which through multicellularity and cell-differentiation were able to grow larger and thereby escape viscous and molecular forces, grow multiple tissues and develop a digestive tract that enables them to process ingested food and to store energy, and develop limbs to direct and propel their bodies (Butterfield 2011).

Simpson, Carl. 2011. *How many levels are there? How insights from evolutionary transitions in individuality help measure the hierarchical complexity of life. In The Major Transitions in Evolution Revisited*, ed. Brett Calcott and Kim Sterelny, 2011. Cambridge, MA: MIT Press.

Butterfield, Nicholas J. 2011. *Animals and the invention of the Phanerozoic Earth system. Trends in Ecology & Evolution* 26, no. 2: 81-7.

Kleidon, Axel. 2010. *A basic introduction to the thermodynamics of the Earth system far from equilibrium and maximum entropy production. Philosophical Transactions of the Royal Society B: Biological Sciences* 365, no. 1545: 1303-15.

Hermann, Weston A. 2006. *Quantifying global exergy resources. Energy* 31, no. 12: 1685-702.

What about the question of *energetics*: how are these different mobility paradigms powered? The overall story is that most energy for all four paradigms is ultimately from the solar radiative flux, but it passes along different routes through the Earth system before becoming available to the moving entities (Kleidon 2010).

Two paradigms (FLOW and DRIFT) are rather tied to their main energy source, which is the uneven way that the solar flux falls across the spherical, rotating Earth, producing temperature gradients and thence fluid motion in the atmosphere and hydrosphere. For the other two (GROWTH and LOCOMOTION) the energy source is more contingent, but on the present Earth this involves some of the solar energy reaching the Earth’s surface being captured by photosynthetic plants and algae (GROWTH), part of which passes into animal populations as food, and part through geological deposition into fossil fuels and hence mobile machines (LOCOMOTION) (Hermann 2006).

Turning briefly to the question of *function*, we can see that there is a less strict correlation between the answers we would give to entities partaking in the different paradigms. Nevertheless, some broad generalisations can be made about the wider functions served by the different paradigms. FLOW powers the world, especially those processes involving DRIFT.

DRIFT and GROWTH build the world—DRIFT forms of suspension and transport are responsible for the tectonic movement of continents and mountain building, the sorting and deposition of sediment and the concentration of minerals into ores and ‘deposits’ (here DRIFT meets GROWTH). GROWTH plays a further role in the physical space-filling emergence of forests and other vegetation communities with all their internal niches.

The DRIFT paradigm with its transport function is also responsible for a large part of geochemical cycling (for example the aeolian dust transported from the Sahara to the Amazon). Plants and fungi use GROWTH for most functions

(including many for which animals would use LOCOMOTION) but typically use DRIFT for the one-off journeys of seeds and spores from parent to hoped-for growing site. LOCOMOTION clearly has an important role in driving natural selection in both prey animals and plants, but with its inherently reversible or repeated motion it also performs a huge range of more specific functions within the lives of individuals, species and ecosystems.

### **The Holocene, the Anthropocene and the Aerocene**

The emergence of the animals called human beings, and their history throughout the Pleistocene and Holocene epochs, initially makes little change to the mobility paradigms of the Earth. But with the development of powered machines—a development closely linked to the birth of the putative Anthropocene epoch—a new species of moving entity joined the LOCOMOTION paradigm, one not

constrained by biological modes of evolution and powered by geological deposits of fossil plant and algae deposits with their stored ancient solar energy. But the Anthropocene also involves other mobility regimes.

Some anthropogenic modes of transport employ the DRIFT paradigm to move passengers and freight passively on metaphorical 'flows' along solid infrastructural systems, adapted in various ways to produce features of LOCOMOTION such as directed motion to an end point. But more significant is the way that the Anthropocene involves employing the GROWTH regime's function of building the structures of the Earth, in its accelerating production of fixed infrastructures such as buildings, roads and cities (Zalasiewicz et al. 2014).

However, the Aerocene calls for a radical departure from this overall trajectory in anthropogenic motion, not least because of the multiple ways that the latter is pushing the planet past its 'safe operating

Zalasiewicz, Jan, Ryszard Kryza and Mark Williams. 2014. *The mineral signature of the Anthropocene in its deep-time context*. Geological Society, London, Special Publications 395, no. 1: 109-17.

Rockstrom, Johan et al. 2009. *A safe operating space for humanity*. Nature 461, no. 7263: 472-5.

space' (Rockstrom et al. 2009). Let's take its signature entity, the solar Aerocene sculpture, and ask our questions of it in turn. In terms of its geometry, the solar sculpture translates, moves bodily, so that it must inhabit either the DRIFT or LOCOMOTION paradigm. Its *mechanology* situates it clearly in DRIFT; breaking with the mechanology of most human-made vehicles it has no front, moves with the flow of the air, and has no on-board energy or limbs to accelerate or direct its motion (and its status as an enclosed parcel of air and its internal convection binds it even more closely to the FLOW paradigm than most drifting things). The *energetics* of its sideways motion is the familiar story of DRIFT powered by the fluid motion of the atmosphere. However, its vertical motion is powered directly by the sun; whereas a tree might use photosynthesis to convert sunlight to GROWTH and thereby grow tall enough to loft its seed into higher air speeds, the solar sculpture achieves the same goal for itself by direct solar heating. But this has mechanological

implications too, and here we must delve into the internal spaces of the DRIFT paradigm.

Within the Earth's atmosphere the DRIFT paradigm has three different size zones. Large objects occupy what we might call the 'gravity zone', and will fall in continual acceleration until they hit the ground; smaller objects such as gliding seeds occupy a 'Stokes zone' in which they follow Stokes Law, reaching a terminal velocity and then drifting down slowly; the smallest particles, less than about 10-5 cm, occupy a 'Cunningham zone': their size is similar to the mean path of air molecules at the Earth's normal temperature, so they are subject to forces that can keep them suspended almost indefinitely (Blacktin 1934: 27-31). Given the size of the solar sculpture or any aerostat, it should inhabit the gravity zone and fall, or perhaps at best the Stokes zone and parachute; however it uses buoyancy to in effect shift up the zones and remain suspended. It is interesting that multicellularity has enabled organisms to become much larger

Blacktin, S. Cyril. 1934. *Dust*.  
London: Vol. Chapman & Hall.

and escape the molecular forces, viscosity and Brownian motion of the Cunningham zone; but in order to effectively use the DRIFT regime for anything but short flights they have to find ways to metaphorically 'shrink' again, so that they can experience the indefinite suspension of the Cunningham zone. Evolution has enabled plants to equip their seeds with wings and pappi that 'lift' even large seeds from the gravity zone to the Stokes and even Cunningham zones of extended suspension. Aerostats like the Aerocene sculpture do the same through buoyancy.

There is another feature of the solar sculpture that links it to yet another set of diverse animate and inanimate participants in the DRIFT regime. Like other aerostats, the solar sculpture can be launched into the flow at a chosen time and place, to try to choose its direction destination in advance. This echoes the behaviour of some other DRIFT denizens.



Perennial streams ‘armour’ their beds with a layer of coarse particles, which means that they only are only entrain small particles into their flow from the ground beneath them during more extreme flood events (Reid and Laronne 1995). Trees such as silver birch time the launch of their tiny gliding seeds by embedding them in catkins that only disintegrate at the right season and in a sufficiently powerful gust of wind to take them far from the tree; slight variation in wing shape also ensures that the seeds will reach different landing sites to increase the chances of some germinating. Flying squirrels in the still canopy layer can launch themselves in a particular direction and glide down to another tree trunk. And birds can not only glide but soar, gaining lift from rising air produced by thermals, weather fronts or slopes, or using dynamic soaring to extract power from variations in wind speed at different heights in a looping trajectory (Vogel 1994: 259-61). The Aerocene sculpture is in good company.

Reid, Ian and Jonathan B. Laronne. 1995. *Bed load sediment transport in an ephemeral stream and a comparison with seasonal and perennial counterparts*. *Water Resources Research* 31, no. 3: 773-81.

Vogel, Steven. 1994. *Life in Moving Fluids: The Physical Biology of Flow*. 2nd ed. Princeton, NJ: Princeton University Press.

Basalla, George. 1988. *The Evolution of Technology*. Cambridge: Cambridge University Press.

Deacon, Terrence W. 2006. *Emergence: the hole at the wheel's hub*. In *The Re-Emergence of Emergence: The Emergentist Hypothesis from Science to Religion*, ed. Philip Clayton and Paul Davies, 2006. Oxford: Oxford University Press.

Finally, there is the fact that the solar sculpture is a designed artefact. In order to appreciate the significance of this we need to add a fifth question to those that we asked of moving entities above, the question of *ontogenesis*: how do individual instances of different kinds of mobile entity arise? Here the correlation with the four different paradigms is even more contingent and shifting. The main innovation in ontogenesis in the Earth was the arrival of DNA-based life, which provided a form of memory that could be passed from one entity to another and make cumulative evolutionary change possible (Deacon 2006: 137). Then animal societies developed extra-somatic technologies and cultural forms of memory, which enabled the process whereby individual moving entities arise to escape some limits imposed by natural evolution. The making of artefacts allowed the combination of forms from different makers and different lineages of artefact (Basalla 1988), rather like the lateral exchange of genetic information and rapid evolution of bacterial lineages. It also

made new forms of cumulative experiment in form possible: whereas organisms can only evolve in incremental steps from existing components, and in ways that ensure that all generations are viable, artefact lineages are not bound by these limits (Arthur 2009: 188; Szerszynski 2016b). Aerocene's participation in the emerging tradition of hybrid art–science–craft experiments positions it within a potential transition in the powers of the Earth to generate new forms.

We have seen that situating the Aerocene solar sculpture within the vast phase space of kinds of mobility within the Earth, divided analytically into its major mobility paradigms, can offer us clues both as to its strange kinship with a range of other moving entities, and to its possible significance in the continuing, evolving story of the planet and its powers. But I want to close by returning briefly to the question of *function*, and how it might help us construct a vision of a 'greater Aerocene' —

Arthur, Brian. 2009. *The Nature of Technology: What It Is and How It Evolves*. New York: Free Press.

Szerszynski, Bronislaw. 2016(a). *Planetary mobilities: movement, memory and emergence in the body of the Earth*. *Mobilities* 11, no. 4: 614–28.

Butterfield, Nicholas J. 2011. *Animals and the invention of the Phanerozoic Earth system*. *Trends in Ecology & Evolution* 26, no. 2: 81-7.

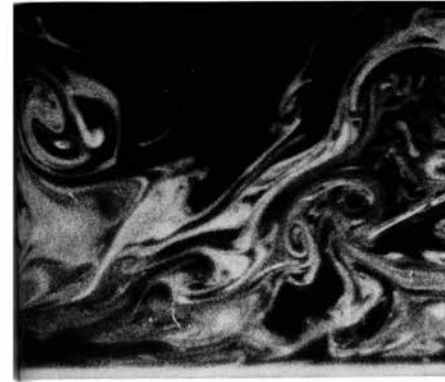
to populate the air with interacting families and lineages of moving entities across all the paradigms and the zones within them. Learning from the contemporary Phanerozoic biosphere, with its high biodiversity, biogeographical variation, trophic levels, rapid evolution and efficient nutrient recycling (Butterfield 2011), can we imagine a new ecology of the air involving entities that confound familiar distinctions between the inanimate, living and artefactual, that occupy different mobility niches and thereby create even more, that—as they that fall, float, fly, sail or soar—interact with each other and with terrestrial beings in diverse ways, performing new forms of recycling and transforming matter, energy and imagination? That would indeed be a major transition in the Earth's history.



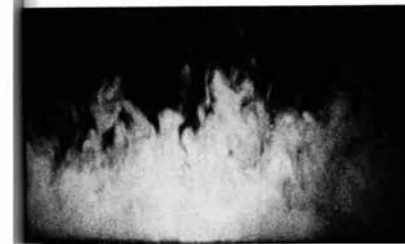
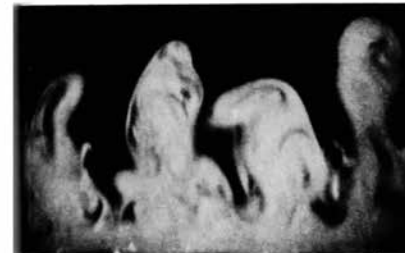
136. Convection in a rotating cylinder. The flow pattern in a rotating "dishpan" heated at the rim and cooled at the center bears a remarkable resemblance to the basic features of the middle-latitude atmosphere of the Earth. Here water 4 cm deep in a cylinder 19.5 cm in diameter is rotating counterclockwise at 30 revolutions per second,

and heated a nominal 150 W at the rim wall. A streak photograph of aluminum particles on the free surface shows narrow jets and a broad spectrum of irregular vortices. The general structure resembles a hemispheric weather map for the upper troposphere. *Fultz et al. 1959*

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162. "Typical eddy" in a turbulent boundary layer. Oil fog is illuminated by a sheet of laser light to show the lower two-thirds of a turbulent boundary layer in side view. The vortex-ring structure just below and to the right of center, which resembles a sliced mushroom leaning left, is an example of what Falcó has called a "typical eddy." It scales on wall variables (figure 161) rather than on the boundary-layer thickness. *Photograph by R. E. Falcó*



163. Oblique transverse sections of a turbulent boundary layer. The flow is viewed head-on, with smoke illuminated by a sheet of light that is inclined 45° downstream from the wall on the left and 45° upstream on the right.

The Reynolds number based on momentum thickness is 600 in the upper pair of photographs and 9400 below. *Head & Bandyopadhyay 1981*

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Milton van Dyke, *An Album of Fluid Motion*, 1982. United States: Parabolic Press. The book is a collection of black-and-white photographs of flow visualizations for different types of fluid flows.

# Life in the Air: Aerocene Explorer

*A Natural History  
Museum Proposal*

Holger Thüs, Anne  
Jungblut, Tom Hill

(The Natural History Museum, London)

The air in Exhibition Road is full of life, but its components are changing. Many organisms use the air as a means to transport propagules to new sites. In an interdisciplinary project we want to use the Aerocene Explorer to sample and study the microbial biodiversity including cyanobacteria, algae and other bacteria, as well as protists, spores of fungi and mosses, the more complex propagules of lichens and vascular plant pollen and seeds in the air above Exhibition Road.

Our aim is to visualize and analyze the diversity of life in the air which is surrounding visitors on Exhibition Road and to compare the composition of the organism mix in the air with communities which are already established on the solid surface of buildings, pavements and trees on Exhibition Road. This will allow us to examine the richness and abundance of life in the air and to test the long standing question in science: if everything is everywhere or if the environment selects. This

comparison will also allow us to explore a window into the future by showing us which organisms are currently arriving via the air, especially lichens, mosses and other plants in Exhibition Road, but may not yet have had the opportunity to find a place within the already established communities. The results will tell us about the composition of airborne biodiversity and the resistance of existing organism communities to change by new arrivals in an urban environment.

## Microbial Biodiversity

Much of life on Earth is microbial and key biogeochemical processes such as photosynthesis, carbon and nutrient cycling, are driven by microscopic life. Microbial diversity is large and most of it still needs to be discovered. Up to 99% of microbes cannot be cultured and therefore they can only be detected through the application of environmental DNA technologies such as high throughput

sequencing. Microbial diversity covers hugely different types of organisms ranging from phototrophic organisms such as cyanobacteria and eukaryotic algae that gain their energy from sunlight. Bacteria and fungi degrade organic material, and some bacteria gain energy from weathering minerals. The extent of urbanised areas is rapidly increasing. However, there is still little knowledge of microbial biodiversity in urban environments which may have implications for ecosystem functions and human health.

## Lichens

Lichens are symbiotic systems, with a fungal component providing a framework in which photosynthetic organisms and other microbes form a stabilized miniature ecosystem, which in itself often resembles a single "super-organism". Most buildings and trees along Exhibition Road already host different lichen communities which often remain

unnoticed, but are constantly changing as a consequence of changes in air pollution and microclimate. Lichens disperse mainly via the air with small to medium sized propagules. These can be either by microscopically small spores of the fungal components alone or by larger, more or less structured combined propagules containing fungal and algal cells together. In large parts of Europe air pollution had—and still has—a major impact on which species of lichenised fungi, algae and cyanobacteria are able to grow at a given site. However—it remains an open question how much of the current cover of trees, rocks and buildings by lichens is reflecting remnants of the past with communities which were adapted to past air pollutant mixtures and now merely “hanging on” to the substrata they have colonised years ago. An alternative hypothesis sees the current lichen vegetation as a direct reflection of the composition of the mixture of lichen propagules in the air. In other words—do lichen communities respond quickly to

changes in air pollution and the available propagules in the air, or is there a resistance in the already established lichen communities on buildings and trees to give way for new arrivals from the air.

## **Bryophytes (Mosses and Liverworts)**

Bryophytes disperse mostly by microscopic spores and can be expected to be captured in the air over Exhibition Road. They are generally faster growing organisms compared to lichens and we can speculate that it should take less time to reach a balance between the diversity of airborne spores and the successfully established species on solid substrata in Exhibition Road. However, this hypothesis has never been tested before and the Aerocene Explorer could contribute to making a first step into this territory. There are additional methodological challenges. Little is known about the success rates of capturing the diversity of airborne Bryophyte spores using culturing

attempts versus molecular tools using a DNA barcoding approach. For this reason, we want to trial both methods by analyzing potentially growing mosses and liverworts among our microbial culturing plates and by using simultaneously sampled replicas with the molecular barcode methods as described for the lichen propagules.

## Pollen

Vascular plants are represented in the air mainly by their pollen. The species and concentration of different pollen types is directly affecting the health of visitors of Exhibition Road, it carries the potential to fertilise and thereby initiate new plant life and pollen which is deposited on all surfaces can become the source of an entire terrestrial food chain. The identification of pollen can be carried out by microscopic features based on standard sampling procedures which are similar to the technology used for capturing microbial life, fungal and bryophyte spores. With the choice of

molecular markers in our DNA-barcoding approach we will also capture a snapshot of the genetic diversity in our pollen samples as a by-product of our analysis of the samples for DNA-barcoding of green algae and other plants.

## The Aerocene Explorer

Aerocene Explorer would enable to sample the air above Exhibition Road at different locations and heights by carrying sampling devices: for example, sticky tape, plates with growth media, rotating glass slides covered in sterilised collecting media or mini high volume air samplers. These samples would be collected within hours and would be compared with the results with a longer term exposure of the same type of sampling devices on buildings and lamp-posts along Exhibition Road from the proximity to Hyde Park to the crossing with Cromwell Road and the green spaces of the Natural History Museum grounds.

## **Environmental sample analysis for microbial, lichen and moss diversity**

High throughput sequencing of the environmental samples will be used to identify the captured biodiversity in the air of Exhibition Road. The 16S rRNA gene will be used for bacteria including cyanobacteria, and green algae and other protists will be identified with the 18S rRNA gene. The so-called Internal Transcribed Spacer region will be applied for fungi, mosses and other vascular plants. We would also like to incubate the air samples in growth media to test if viable cyanobacteria and algae were captured from the sticky tape. Lichens and mosses do not grow under these conditions and can only be analysed by molecular tools. The same methodology will be used to complement the culturing from the harvested living organisms on the sticky tape and the collecting media from the glass slides. This combined approach is necessary because not all organisms can be cultured and for

others, the opposite problem has to be tackled—they provide a traceable genetic signal only after amplifying their biomass by a culturing period before the genetic analysis.

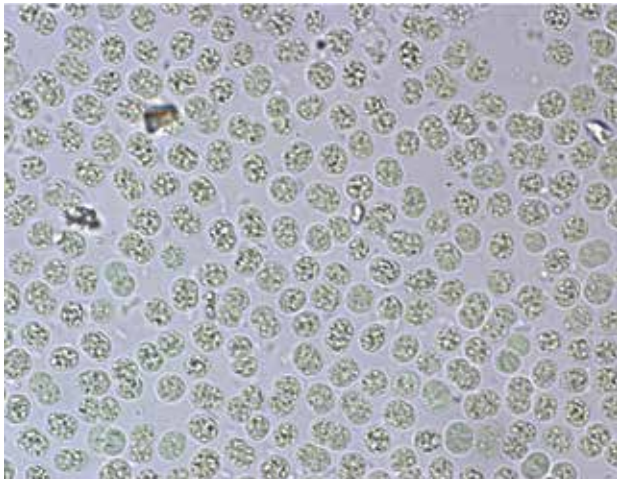
## **Additional opportunities for associated citizen science on Exhibition Road**

In addition to the sampling of propagules from the air, this approach is ideally suited for an assessment of already established lichen vegetation on the buildings and living substrata (e.g. trees) along the entire Exhibition Road. This assessment can be combined with crowd-sourced imaging of building surfaces which can be interpreted by NHM specialists to complement our own assessment. This part of the project can also be embedded in a “Bioblitz” along Exhibition Road in order to capture as wide a range of organisms as possible and provide further opportunities for the public to contribute to our science and interact with our specialists.

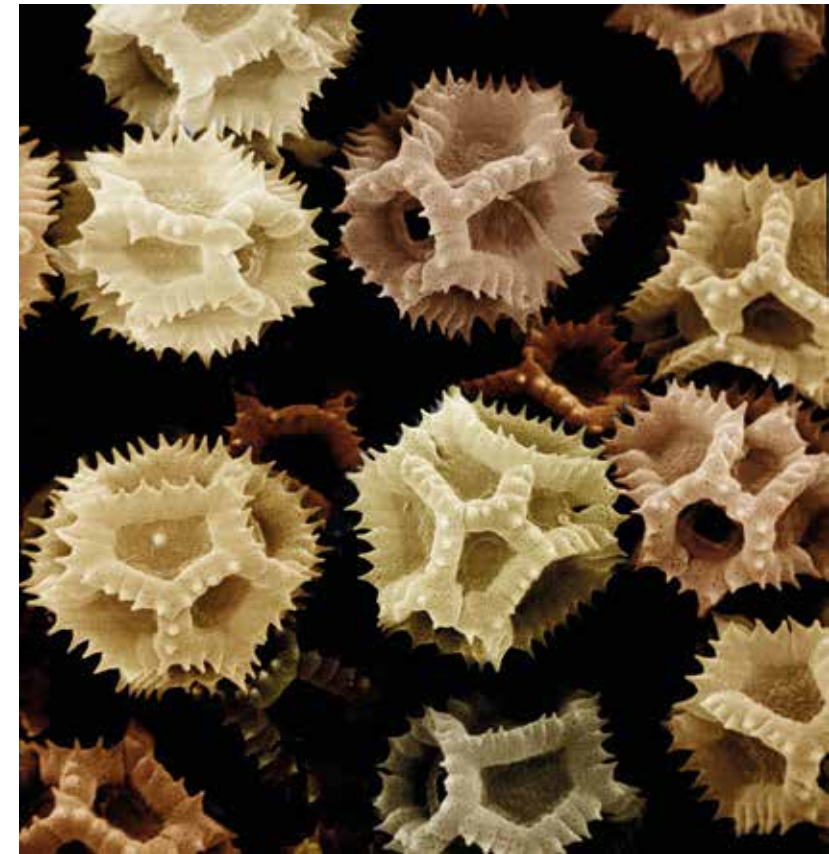




**fig. 1**



**fig. 2**



**fig. 3**

**fig. 1** Three lichenised fungi *Caloplaca (Calogaya) decipiens*, *Phaeophyscia orbicularis* and *Lecanora dispersa* on a fence post at the Natural History Museum on Exhibition Road.

**fig. 2** The cyanobacterium *Microcystis* from a sample taken on Hampstead Heath.

**fig. 3** Scanning Electron Microscopy Image of pollen grains of *Lactuca sativa* (lettuce), with an average grain diameter of 20µm (0.02mm), BM3240.

# Levitate in the Aerocene

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Peter Adey

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Eliade, Mircea. 1964. *Shamanism: Archaic techniques of ecstasy*. London: Routledge & Kegan Paul.

Calvino, Italo. 1988. *Six Memos for the Next Millennium*. Cambridge, MA: Harvard University Press.

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From what we know of levitators and their history, the *Aerocene* may hark not to a future but our past. Floating free is in some ways much more primordial than a post-Anthropocene world; it is a skill we might have once known or possessed. We could experiment with other, mostly pre-Anthropocene imaginations of inhabiting the aerial, where we had dreamt to float and drift untethered from resource intensive energy sources, and, in-fact, much in the way of support. Instead we were held up by spiritual and religious belief, mediaeval tradition, passion, will and psychic energy. I'm thinking of the histories of mesmerism, stage show trickery exemplified by figures such as Harry Kellar, The Great Hermann; Alfred Sylvester, and street magic, or mediums like the famous DD Home, Mrs Guppy and Eusapia Palladino. Traditional societies also have long histories of shamanic belief that hold to a primordial ability to fly unaided, so argues Mircea Eliade and Italo Calvino (Eliade, 1964; Calvino, 1988). Religious traditions hold levitation up within their

hagiographies of Catholic saints. While even our ideas of sovereignty have possessed a *levitative* disposition, kings and princes hovering somewhere between the ground and the sky and their earthly and heavenly bodies— their two bodies (Kantorowicz, 1957). Other traditions might assist from the history of science too. Steven Connor’s recovery of the debates over gravities and levities in early modern science, help us to find levity as the opposing force to gravity (Connor, 2009).

It is as if the Aerocene, in compelling us to inhabit this new epoch—to float minimally in a way that is subject to wind and sunlight, and not much motive force— invites a rediscovery of more a primal and stranger history of levity. We must pass over a largely Anthropocene imagination of flight that was born of speed, thrust and the depletion of resource, and remember an earlier and parallel form of levitating, not flying (see for instance Pascoe, 2002). But we should be careful here too, because levitators quite often

Kantorowicz, Ernst. 1957. *The king's two bodies: A study in medieval political theology*. Princeton: Princeton University Press.

Connor, Steven. 2009. 'Absolute Levity' *Comparative Critical Studies*, vi/3, pp. 411–27.

Pascoe, David. 2002. *Airplane*. London: Reaktion Books.

speak to separation, disconnection and detachment.

## Cuts

Levitation, like Saraceno’s free flight, is often about a kind of detachment from the threads that tie us to the ground, and an embrace of a weaker, distant and immersive force like the warmth of the sun. The sun is complicit in many street performances of levitation and other risings, especially the Indian rope trick which tended to be arranged in such a way that the audience were staring into the sun. The sun cuts. The sun severs our visibility of the trick, cuts the usual rules of gravity, and in some variations of the trick, a boy—having clambered up the rope— returns to earth apparently decapitated, only to appear safely elsewhere. Other threads are woven and cut for magical flying machines, as Marina Warner shows in the flying carpet, used to navigate the great Library of Alexandria (Warner, 2011).

Warner, Marina. 2011. *Stranger Magic: Charmed States and the Arabian Nights*. New York: Vintage Books.

The only relation between the carpet and the ground are the magnetic forces upon which it floats, as if aerial rails. Stories of sovereigns frequently transpose the king with the Sun too (Serres, 1989). Alexander blocks out the sun from Diogenes in a signal of absolute sovereign power.

And so I'm worried that the Aerocene might mark a kind of separation and division. What if were to ask what patterns of life are necessary for living in this epoch that are different to the Anthropocene? If we are moving slower, and we can muse on the Earth being split into northern and southern hemispheres because of the limitations of the air currents upon which the *explorer* will depend, our economies, societies and cultures would be drastically divided according to these kinds of slower and wandering mobilities. Who might the Aerocene bring with it, and who might be left behind?

Serres, Michel. 1989. *Detachment*. Athens: Ohio University Press.

Potočnik, Hermann. 1995. *The Problem of Space Travel: The Rocket Motor [1929]*. Washington, DC: DIANE Publishing.

González, Juliana. 2008. 'Mundo y trasmundo de Remedios Varo' in Ricardo Ovalle, Remedios Varo catalogo razonado. Mexico City: Ediciones Era.

## Estrangement

Early space engineers, such as the Slovenian scientist Herman Potočnik, anticipated in the 1920's the possibilities of sensory disorientation in the weightlessness of space (Potočnik, 1995). Levitation from space flight would detach future astronauts from all fixed coordinates. What kind of disorientations and detachments will the Aerocene cause us to encounter? Narratives, stories and performances of levitation are full of highly classed, gendered, overtly sexualised and exploitative experiences and relations.

Take Remedios Varo, surrealist friend of Leonora Carrington, who would both escape Europe to post-revolutionary Mexico in 1940. In Varo's works a lot of things float. But she also depicts inequalities, women that stitch subjects and kites into the air on gossamer threads. Women are seen floating, but ensnared in the beards of men (Varo in Gonzalez, 2008).

In Varo and others, a rising body may not be a show of freedom, but a submission, a diminishment and a lessening of capacity. In the short film *The Karman Line* (2014), Olivia Colman is ever so slowly lifted off and rises to eventually cross the Karman Line boundary when the atmosphere becomes too thin to support the lift necessary for air flight. The film is a commentary on family detachment and figurative estrangement to the slow loss of a mother from the home. Colman's levitation slowly stretches and collapses marital-conjugal, motherly, familial and terrestrial attachments. Floating may bring fracture.

## Groundless

Levitation can be a maligning impulse too; from the deckchair aeronaut/'Lawn Chair Pilot' Larry Walters to the Jewish notion of *luftmenschen* — men of air — living without ground-ing, without support. Levitation has been a derogatory and even self-critical move that is disparaging

Neumann, Boaz. 2011. *Land and Desire in Early Zionism*. Brandeis: Brandeis University Press.

Scott, Kim. 1999. *Benang*. Fremantle, Australia: Fremantle Arts Centre Press.

of intellectualism as an apparent superfluousness. Boaz Neumann explores the derogation of the exilic *luftmensch* Jew, whose itinerancy lacks a connection to the soil (Neumann, 2011). The idea of the resettlement of Israel and the allegiance to working the land were at complete odds with the levitating figure who seemed to work against this yearning for a homeland, and the submersion of body and language within the soil. As Neumann argues, because 'the exilic Jewish body was not part of a territory, it lacked solid existence'.

Levigators are even expressed in post-colonial literature, where magic becomes an indigenous 'special effect' which unsettles rational, ordering and divisive colonial narratives. In a novel driven by Western Australia's Department of Aboriginal Affairs policy of seeking to 'breed out colour' by racial 'uplift' into White families, a child begins to levitate (Scott, 1999).

## Levitate Together

This is not to put an unintended *down-ner* on the Aerocene that is so lifting and so up, but to warn of wider cultural connotations and histories and provoke other critical responses to free flight. Because if the Aerocene is about floating and not such an assertive mode of flying, in what ways will our mobility whether we are lifted by the explorer or we send it off flying, be able to share the air? We have seen how levitators are often exclusive, either the wielders or objects of power. Other kinds of mobilities produce very obvious exclusions. The car requires an infrastructure that is often highly inhospitable to other kinds of life—walking humans, cyclists or hedgehogs.

Perhaps we could take further comfort from wider representations of levitation that portend to a more utopic levitative future, one that is not singular, so exclusive, or marginal, but lived together. Illya and Emilia Kabakov's works *The Flying*,

is a series of images woven into enormous carpets displayed in the Dewer Gallery in Belgium between 2005-2006. The Kabakov's works, and Illya had also drawn similar levitating figures in his 'The Flying Komarov', the sixth album in his series *Ten Characters*, features numerous hovering bodies and even furniture, flying, sitting, drinking above cities, countryside and other landscapes. His subjects float together. They are hospitable. Close. They face one another. They hold hands. And they gesture towards what ethical relations and engagements should be necessary to cohabit the air. The levitators might tell us how to subsist, drift and move more slowly and potentially together, rather than apart.



fig. 2

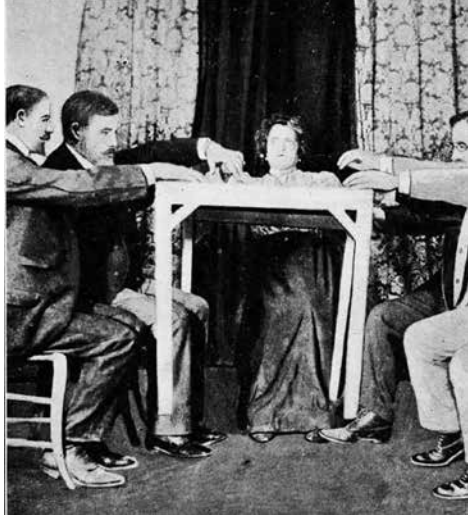


fig. 3



fig. 5



fig. 1



fig. 4

fig. 1 Ilya Kabakov, *The Flying Komarov* from *Ten Characters*, Portfolio of 32 lithographs, offset printed, mounted on board, 1994.

fig. 2 Remedios Varo, *Locomoción Capilar*, 1959.

fig. 3 Boston, Small, Maynard & Company, *Levitation of a table during a seance with Eusapia Palladino*, 1909.

fig. 4 Ilya Kabakov, *The Flying Komarov* from *Ten Characters*, Portfolio of 32 lithographs, offset printed, mounted on board, 1994.

fig. 5 The thin line of Earth's atmosphere and the setting sun are featured in this image photographed by the crew of the NASA International Space Station while space shuttle Atlantis on the STS-129 mission was docked with the station.

# life : skin : aerocene

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Andreas Philippopoulos-  
Mihalopoulos

## 1. life: singular

To be connected.

And to be withdrawn.

Life means to be at the same time *here* and elsewhere. To be part of life is to listen to the needs of my body, and pursuing them, sucking from all around the juices that help me carry on; and, simultaneously, to be retreating inside, to the bubble of the self, closing off against the world. To belong to a network, an assemblage, a moment. And to never be totally, fully, really connected. To be inside, and to be outside. Life means to be *a part*, and to be *apart*.

Each body has its own life, and while one regularly shares moments of one's life with others, a life as such cannot be shared. Life is singular. As a singularity, a life is absolute. It cannot be compared to other singularities. What is the point of saying, your life is better than mine? How does one know a different life? How does



one know even one's own life? Life is pure incommensurable difference, complete and self-enclosed: it is pure immanence. This means that there is nothing outside life, no possibility of transcending from a life onto something other, further, better, more just. This immanence, however, is different to the usual theological constructions, where this world and the next are in a continuum of the type 'buy now, pay later' — or 'pray now, reap later'.

Here I am talking about an immanence that has no gradations and cannot be attributed to individual deeds, prayers or wishes. Here, I will be talking about the inescapability of life that spreads across all bodies, animate and inanimate, and takes force from within the body, whether this is a breathing being or a floating Aerocene fold of air. This life force connects a body to the world while simultaneously allowing it to withdraw to the nest of its own skin.

## 2. life: to be *a part*

To be alive is to be connected to the world. The connection does not have to be through senses or breath, as life is usually understood. I want to think of life as what characterises the world as a whole, and all the bodies within. Not limited to the usual animate/inanimate distinction, I would like to suggest life as a force of self-maintenance and self-perpetuation that exists in every body, and that pushes it towards connecting with other bodies. This is the Spinozan *conatus*, namely the will of each body to carry on being and becoming, "the endeavour or struggle to persist in being." (Gatens and Lloyd, 1999: 26). Deleuze puts it even more polemically and indeed juridically when he writes, "the conatus defines the *right* of the existing mode. All that I am determined *to do* in order to continue existing (destroy what doesn't agree with me, what harms me, preserve what is useful to me or suits me)... all this is my natural right." (1988, 102)

Gatens, Moira and Genevieve  
Lloyd. *Collective Imaginings:  
Spinoza, past and present*.  
London: Routledge, 1999.

Deleuze, Gilles. 1988. *Spinoza:  
Practical Philosophy*. trans. Robert  
Hurley. San Francisco: City Light Books.

This understanding of life is inspired by the work of feminist writers, such as Rosi Braidotti (2012; 2013), who talks about *vitalism* as a force of becoming. Braidotti goes beyond the classic distinction between *bios*, reserved for humans of a certain type only that tends to be the glorified cudgel of Enlightenment humanism (white, male, heterosexual, European and so on); and *zoe*, which encompasses non-human life. It is indeed important to resist this distinction, mainly because it has been co-opted in order to produce and legitimise further distinctions that lie in the core of the exploitation of nonhuman species by humans: *zoe* in the service of *bios*, nonhumans in the service of the good human life.

I would suggest that we should go even further. Life should be extended to animate and inanimate alike, if we imagine life to mean, quite simply, *to be a part*. Everything is *a part* of something else, not in a pyramidal, hierarchical manner, but in an assemblage way where

Braidotti, Rosi. 2012. *Nomadic Theory*. New York: Columbia University Press.

Braidotti, Rosi. 2013. *The Posthuman*. Cambridge: Polity Press.

Latour, Bruno. 2005. *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford: Oxford University Press.

causalities become chaotic and connections become hypercomplex (Latour 2005). The contrast between *bios* and *zoe* is indicative, not merely of anthropocentrism, but of an omnipresent, movable, fractal boundary between hierarchically positioned (animate and inanimate) bodies, organised in some enlightenment-infused fantasy of harmoniously centralised imperium, where Man (masculine and capitalised) in the centre dominates and determines all distinctions.

Life is actualised in *bios* and *zoe* and is given to any body which, in its turn, is given to a life. It can blossom in an insect, a marine environment, a stone, an Aerocene sculpture, or a planet. As long as it is a part of this infinite continuum, it is life.

### 3. life: to be *apart*

To be alive is to be able to withdraw. Life is a rupture of the vast, flat, unequal

continuum on which all bodies circulate (Philippopoulos-Mihalopoulos 2014). Life is carved out of that continuum, but also takes a distance from it. It creates a space for itself, in which it can be nurtured. It builds a nest or a hole in the ground, a global womb that circles the body and folds life around it. Life is, quite simply, to be disconnected from the vertiginous speed with which the world continually emerges. It is a body's ability to withdraw. Life is to be apart.

Withdrawal is one of the points of difference between what I propose here and current understandings of assemblage thinking, be they Latourian networks (2005), vitalist flows, or other new material ontologies. I employ withdrawal as a quality that does not contradict but rather enables assemblage formation. Withdrawal and assemblage, being apart and being a part, are not dialectically opposed values. There is no difference, only parallel folding of one into the other. Every singularity assembles itself in larger bodies while at the same time withdrawing from the

Philippopoulos-Mihalopoulos, Andreas. 2014. *Spatial Justice: Body Landscape Atmosphere*. London: Routledge.

Latour, Bruno. 2005. *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford: Oxford University Press.

Deleuze, Gilles and Felix Guattari. *A Thousand Plateaus: Capitalism and Schizophrenia*. trans. Brian Massumi. London: Athlone Press, 1988.

Deleuze, Gilles. 2006. *The Fold: Leibniz and the Baroque*. trans. Tom Conley. London: Continuum.

ontology of the assemblage. Withdrawal has been referred to by Deleuze and Guattari (1988) in the context of their discussion on Nietzsche, where the movement was linked to the schizophrenic and her revolutionary potential. This is a *strategic* understanding of withdrawal, in the sense of a machine that goes against issues of identity, origin, causality, and other enlightenment cudgels.

There is also another, complementary way of thinking about withdrawal. In his work on Leibniz, Deleuze (2006) refers to the famous formula of the monad as “no windows.” There is no opening in Leibniz’s monad. A monad is “an inside without outside” (Deleuze 2006, 31). Every body is a closure that withdraws from full openness, connectivity or exteriority, and into a monadic singularity that is gathered around its need for perpetuating this singularity. Its openness rests on its closure. This is the crux of autopoiesis, namely the simultaneous closure and openness of systems, like cells, that

Varela and Maturana (1972) had suggested in the 70s and which Luhmann (e.g., 1995) has subsequently made it the core of his social theory of autopoiesis. Openness rests on closure. Assemblage rests on withdrawal.

Graham Harman positions himself in similar terms when he writes that “objects enter relations but withdraw from them as well; objects... exist, not in relations but in a strange sort of vacuum from which they only partly emerge into relation” (Harman 2009, 132). The above shows that objects (here: bodies) withdraw not just from each other but also from themselves. This is the crux of the foundational unknowability of bodies, or as Spinoza said, we do not know what a body can do: a body never fully presents itself to itself. In that sense, withdrawal is ontological. The world is what each body makes of it. But this is not relativism or subjectivism. The world withdraws as much as the body withdraws. “Everything withdraws into itself” (Harman 2009, 113).

Maturana, Humberto, and Francesco Varela. *Autopoiesis and Cognition: the Realization of the Living*. Dordrecht, Holland: Reidel Publishing, 1972.

Luhmann, Niklas. 1995. *Social Systems*. trans. J. Bednarz, Jr. Stanford, California: Stanford University Press.

Harman, Graham. 2009. *Prince of Networks: Bruno Latour and Metaphysics*. Melbourne: re.press.

Spinoza, Baruch. 2000. *Ethics*. trans. G. H. R. Parkinson. Oxford: Oxford University Press.

Life, therefore, has two simultaneous characteristics: being connected and being withdrawn at the same time. Each body is both “withdrawn” and gathered in itself (for how else would it be singular), and at the same time connected to other singularities (for how else could it carry on).

## 4. life: a life

Written shortly before the end of his life, Gilles Deleuze’s *Pure Immanence: Essays on A Life* (2001) talks about the pure immanence of a life in a way that is not anchored to a subject, a being, or even a supreme being. Methodologically, pure immanence cannot be understood through empirical connections. No doubt, one necessarily begins with them; but they soon need to be left behind, if one wants to pass on to a life co-extensive with pure immanence. What does that mean? That most of us are already individuals, born and raised in a way that we understand our identity as unique and

specific to us. And we do this through empirical observations, such as that I am different from you, from this table, from this plant, so therefore I am me. But this is not the end of the flight. This is not enough for pure immanence. From being an individual to being pure immanence, there is an important passage to be crossed. This is the passage from the life to *a* life, or, to put it differently, from *individuation to singularisation*: “a man who no longer has a name, though he can be mistaken for no other. A singular essence, a life” (2001, 29).

A (with the ‘a’ italicised, as Deleuze would have it) life, therefore, is something that escapes identity categorisations (such as the ones that come with naming and responding to our name). A life is more than identity.

It is spatially everywhere, actualised in subjects and objects, yet exceeding them. It is also temporally everywhere, but not continuously. Its everywhere-ness is ruptured and sharded in *entre-moments*

Deleuze, Gilles. 2001. *Pure Immanence: Essays on A Life*. trans. Anne Boyman, intro. J. Rajchman. New York: Zone Books.

(“between-times”). It is connected to *the* life (the life of an individual, working and living through the usual everyday empirical actions) in a parallel way: there is correspondence and coexistence but no connection in the traditional sense of causality or anticipation. A life is virtual, namely real but not actualised.

It is pure potentiality, febrile future, pulsating present. Its virtualities become actualised through the bodies and objects of *the* life; but *a* life itself remains purely virtual, an event and a singularity.

## 5. life: aerocene

Every Aerocene flight is a singularity. One never knows how a particular flight might unfold, how connected or withdrawn the Aerocene will be. This is a massive fold of air, hefty-looking but remarkably light whose route is hard to predict. A fluttering black envelope that absorbs light and heat, the Aerocene needs to stay connected to the bodies around it in order to

become lighter-than-air and fly. It must remain connected to such bodies as the cord that keeps it in place and softly nudges it; the air, the sun and the temperature generated within the fold; the difference between inside and outside the fold; the people looking at it, the buildings or trees around it. A flight is all about connection, to be part of something larger, which becomes alive simply by being connected: the wind becomes phenomenologically visible and ontologically instrumental; the trees become bodies to play with but also avoid; the cord becomes the tool of that great human illusion of control.

Yet, the Aerocene fold also excludes. It cannot include its environment, nor pretend to be connected constantly. It needs to separate itself from the outside. It needs to keep the air warm inside, thus discouraging free circulation. It needs to carve a space for itself, nominate it, and allow itself to withdraw in it. A flight is all about withdrawal, to stand apart from everything. The fold becomes bloated with

itself, bellowing a conative substance that fills it up and lifts it up, that *makes* it what it is.

At the same time, the fold withdraws even from itself. Every withdrawal is self-withdrawal, as I've ruminated elsewhere (Philippopoulos-Mihalopoulos 2014). Which one of us can say that we really know ourselves? The Aerocene withdraws from its empirical dimension (the stuff it is made of), withdraws from its actuality, and in losing its identity, becomes elemental. Just as a life, the Aerocene relies on the actuality of matter (the balloon, the cord, the gloves that hold the cord, the human that wears the gloves), but flies towards virtuality, clumsily but elegantly trying to actualise it.

What is it, then, this project of the Aerocene that manages to bring together hundreds of people, experts and passers-by, whiz-kids and luddites, hackers and ponderers? Yes, it is a gauche balloon trying to levitate, occasionally flying,

occasionally going a bit out of control. But also: it is Icarus-in-a-flat-pack, humanity's wet dream of finally becoming god, looking at everything from above and indulging the virtuality of apotheosis; it is the ultimate reliance on the elements, dispersed in the aether yet connected to transcontinental, even interstellar, bodies and routes; it is the pinnacle of connection; and it is also a withdrawal to the most basic technology that one could ever imagine: no noisy engines, no unnecessary parts, indeed no *parts* but itself. It is human's shot at levitating eternity through the most basic means. The Aerocene is always tending towards something, always a part, always apart. It is a singularity of a life.

## 6. life: inside/outside

The core paradox of life, that between being a part and being apart, relies on a most basic technology: the line that separates inside from outside. Aerocene's

skin tears the air in two: inside, warm woolly womb; outside, a tide of freeform coolness.

This is the basic technology of Aerocene's flight: to have a skin that allows the inside to become lighter than air. Only in this way will the billowing fold exclude the very air that pushes it down, while including the air that will become airer-than-air, rarefied breath of belonging.

We know, however, that skin does not only separate, but also connects. Michel Serres writes: "the skin is a variety of contingency: in it, through it, with it, the world and my body touch each other, the feeling and the felt..."

I mix with the world which mixes with me. Skin intervenes between several things in the world and makes them mingle." (2008, 80). Skin's intervention to the world *makes* the world. In separating bodies, skin paradoxically assembles them together and allows them to mingle. "Contingency means common tangency... Everything meets in contingency, as if

Serres, Michel. 2008. *The Five Senses: A Philosophy of Mingled Bodies*. trans. M. Sankey and P. Cowley. London: Continuum.

everything had a skin.” (2008, 80). The contingency of skin is this: the inside and the outside touch the same surface. The wind touches the black Aerocene skin, which, in its turn, touches the warm air inside. But contingency is also this: there is no difference between inside and outside. Whatever is inside, can and will become outside at some point.

The differentiation between inside and outside is necessary (for all sorts of biological, psychological, technological, and above all epistemological reasons) but is ontologically false. There is no difference between inside and outside. There are of course sides to the skin: this side of the skin and that side of the skin, and the way the skin folds around the space of separation. But the bubble has burst, the glass-house has collapsed. We are all exposed to the manic currents of the outside, even when we think that we are safely ensconced inside. Or, to put it immanently: there is no outside (Nietzsche, 2005, 175). We are dwellers of a vast inside, as vast

Nietzsche, Friedrich. 2005. *Thus Spoke Zarathustra*. trans. G. Parkes. Oxford: Oxford University Press.

as any outside could have been. At the bottom of the paradox, there is a line that folds them into one. At the bottom of the Aerocene, there is a hole that allows the air to circulate freely. Inside and outside are made continuous and contiguous, capturing the contingency of positions in one large fold of air. The air that withdraws inside is the same as the air that connects outside. The paradox of a life ends up being a flat, unfolded continuum, where connection and withdrawal are identical.

## 7. life: law

The paradox of being connected yet withdrawn is the juridical core of the Aerocene. The Aerocene is all about floating, levitating, flying: in short, moving. This movement is determined by conatus itself, “the right of the existing mode.” The Aerocene is not a free flight. It is a carefully programmed contingency, a time-slotted opportunity (determined by the wind,



the sun, its heat and so on) taking place in a juridically determined, proprietary space of possibility—in this case, the Imperial College’s gardens. The transcontinental Aerocene traces the planetary currents and calculates how long one needs to fly aerocentrically from, say, London to Buenos Aires, taking into consideration the night chill, the oceans, the cities underneath, even the meteorological improbabilities. It also needs to take into consideration the international, regional and domestic laws of airspace, the political regimes of countries at war, under terrorist occupation, or plainly uncooperative states that will not allow the use of their airspace. For this reason, the movement of the Aerocene is a process of constant connection to such physical and symbolic regimes.

Following the paradox, though, the Aerocene is also fully withdrawn. It is not about reaching Buenos Aires, but about flying aerocentrically from somewhere to ‘wherever’. It is not about causing chaos in international airspace, competing

Philippopoulos-Mihalopoulos, Andreas. 2016. Withdrawing from Atmosphere: An Ontology of Air partitioning and Affective Engineering. *Environment and Planning D: Society and Space*, Vol. 34(1): 150-167.

with drones and airplanes for the same routes, but about becoming a possibility for collectivities around the globe to construct their own Aerocene and explore what it means to fly (Philippopoulos-Mihalopoulos 2016). Finally, it is not about a scientific study of data collection, but about the exploration of the planetary palimpsest. If while en route, regimes change, solid data is collected and put into good use, and Buenos Aires is reached, all the better. But the core of the Aerocene is withdrawal to a project free from connections, singular and incomparable. The Aerocene is a billowing waft of a vision that covers the globe, gets thousands of people excited, aims to be thought in parallel to the Anthropocene, and flies, regardless of heat, winds and laws.

At the bottom of everything, we encounter once again a life: a singularity, a monad that goes alone, a nomad that withdraws. To this singularity, I would always add the law that determines the movement of this singularity, indeed of

every singularity: the law that moves the Aerocene (just as it moves everything else) is the juridical force of necessity of simultaneous connection and withdrawal. In moving, flying even, the Aerocene constructs its very own *lawscape*, namely it determines the law of the space around it, as well as the space in which its law will take place. It constructs its own law of movement in a visionary juridical, political, meteorological, biological regime, fully absorbed by its technicalities, yet also glisteningly connected to the world.



fig. 1



fig. 3



fig. 2



fig. 4



fig. 5



fig. 7



fig. 6

fig. 1-7 Andreas Philippopoulos-Mihalopoulos, Series of images taken from *Picpoet*, 2015. Ongoing. *Picpoet* works on text pieces combined with visuals, iphoneography, and performance work. Picpoetry is published on instagram as atmospheric captures of specific moments in text and iphoneography. [picopoet.net](http://picopoet.net).

# The Atmosphere

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Sir Brian Hoskins

I first met Tomás Saraceno some 5 years ago when we were paired together in an Art-Science event at the Tate Modern. He was bubbling over with the idea of people, and even cities, floating in the atmosphere. For more than 40 years I had been applying my maths to the understanding of how the atmosphere moves in weather systems. It was great to come from our very different directions and share our enthusiasm for our atmosphere, something ignored by most people, most of the time. Yet the atmosphere, and the winds that animate it, are crucial components to the Aerocene project in which I came to participate in November 2016.

The atmosphere surrounds us, we breathe it, all nature depends on it. It comprises some two thirds of what we can see if we look in all directions (including upwards), and we become aware of it when it moves (“wind”).

Viewed from space, the atmosphere around the Earth is thinner than the skin

of an apple. Viewed from our perspective, the atmosphere above is so heavy that it is pressing in on us from all sides, 10 tonnes on a square metre! The atmosphere contains the oxygen that life needs, but any more and fires would dominate our Earth. Water—evaporated from the oceans and land—is carried as water vapour by the moving atmosphere, condensing to form clouds and falling back to the surface as rain or snow.

In the absence of clouds—in conditions that suit the Aerocene sculptures flown by Studio Tomás Saraceno and many other colleagues and friends—the light from the sun passes down through the atmosphere giving the energy for life. The atmosphere acts as a blanket around the Earth, making it more difficult for the heat to escape, stopping our Earth being a frozen ball in space.

The Earth turns around on its axis in a day and the atmosphere nearly moves with it. The speed is so fast that, viewed from space, a jet aircraft flying westwards

would be seen to be actually moving in the opposite direction, though not as fast as the place on the Earth where it took off from! The relatively small difference between the motion of the atmosphere and the turning of the Earth is what we call the wind. It is not so common that we think of wind in this way, yet it is precisely the wind that may offer us novel forms of moving and being in relation to our Earth.

The tropics receive more sunlight than the higher latitudes and so they are warmer. Along with the rapid turning of the Earth, this means that westerly winds become stronger with height. Away from the tropics, the weather systems feed off the temperature contrast. They can be thought of as composed of giant conveyor belts moving both warm moist air from low levels in the tropics towards higher levels in the polar regions and cold, dry air from higher levels in the polar regions towards lower levels in the tropics. This exchange of air leads to heat being transported both upwards away from the surface, allowing

it to escape to space, and towards the polar regions, making them less cold than they otherwise would be.

If a balloon of air is heated near the surface to become warmer than the air around it, it will tend to rise. However, as it rises to a region of lower pressure, the air in the balloon will expand. The work it does in pushing the surrounding air outwards makes it cool. Often this means that it will be cooler than the surrounding air at this level and it will start to fall back again. An extra ingredient in the atmosphere is that the moisture in the air in the balloon may condense to form a cloud, and in doing so it warms that air so that it may be able to rise further. This is what happens in a thunderstorm, where the balloon of air may be able to ascend as high as 10 or 15km, particularly in the tropics.

Tomás Saraceno, like me, continues with his enthusiasm for the atmosphere. His focus is now on the Aerocene project.

On a November day, in a quiet garden, in the middle of London, it was striking to see this huge Aerocene Explorer sculpture quietly take off, on its own. How does it do this?

Being black, the Aerocene Explorer absorbs sunlight. It warms up and so it rises. It will continue to do this while it can absorb enough sunlight to keep warmer than the surrounding air, despite its expansion and the associated cooling. If it gets high enough it will usually move eastwards with the westerly winds. It will also get involved with the weather system conveyor belts, sometimes moving southwards for a few days and other times moving northwards.

A similar behaviour can be seen in a visualisation of air movement shown in the figure. Scientists on an aircraft flying over the North Sea at an atmospheric pressure of about 400hPa (a height of about 7km) had collected samples of air and were interested in the origin of the chemicals

they found. They used data prepared for weather prediction models to tell them where it had come from in the previous few days and where it would go in the next few days. In the figure, the upper panel shows the horizontal position of the air and the lower panel, its vertical position. At the time of the sampling of the air, it is all at the location of the aircraft, close to 30E, 52N and 400hPa. In the picture, colours are used to show air whose trajectories behave in a similar manner. Some of the air (yellow) had come almost due east from slightly higher over North America. Other neighbours (orange/brown) had risen from near the warm ocean off Florida and moved north-eastwards. After the sampling time, most of the air turned southwards and descended strongly over the Mediterranean or North Africa. However some (orange/brown) continued on eastwards with only small descent.

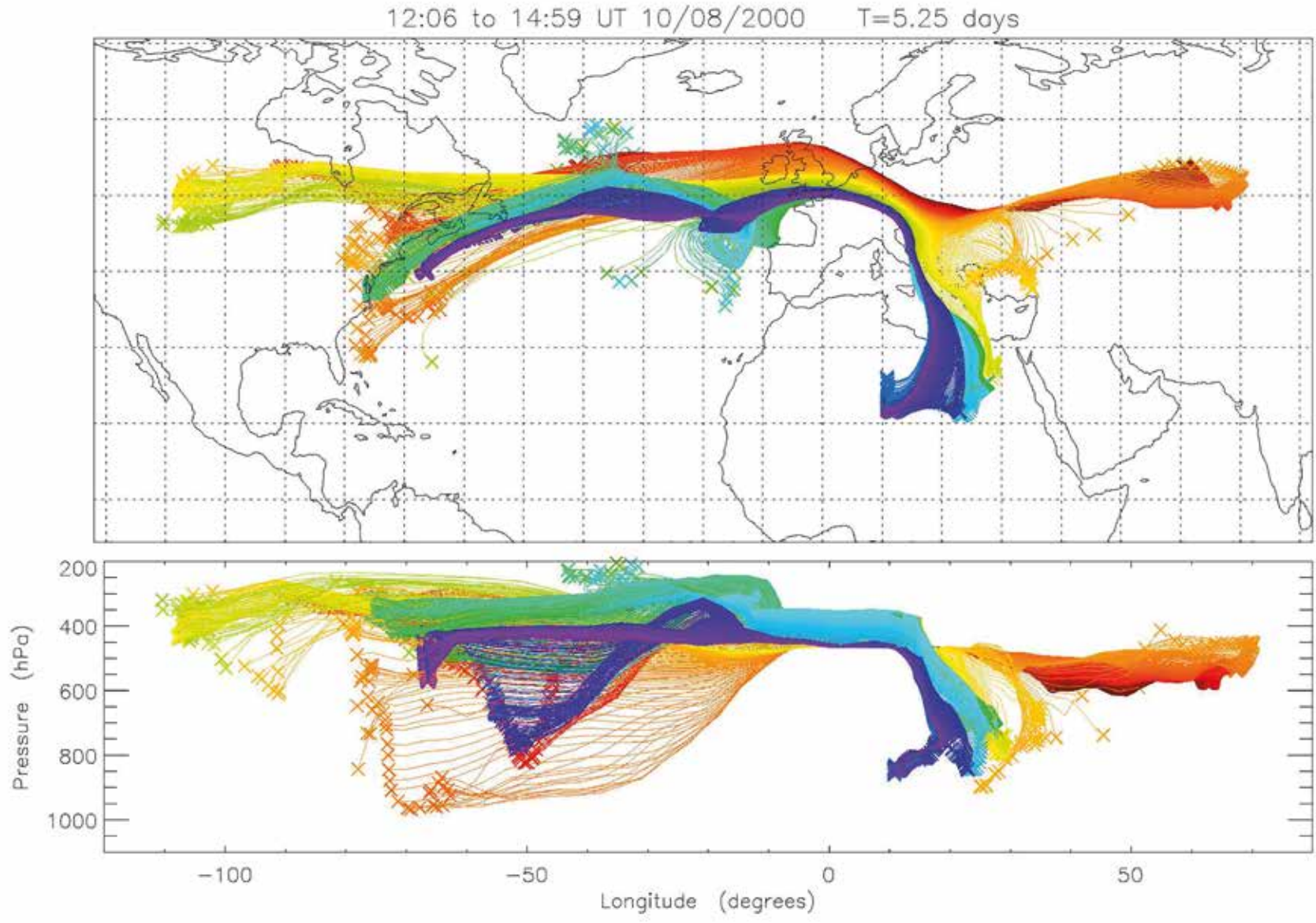
The Aerocene could join in with such air motions, zig-zagging around the world.

In its equatorward excursions it could enter the tropics and start to turn around and move westwards.

Very occasionally, it could even cross the equator and sample the other hemisphere. The winds from weather forecasts for the next week or so can tell us where the Aerocene is likely to go in that time. Alternatively, if we want it to take us as close as possible to a particular city, perhaps in another continent, the forecast winds can be used to tell us the best time to take off.

Just like the different streams of air in the figure, as we travel to different places we will continually encounter new neighbours who started from somewhere else; we will stay with them for a short time and then move on. The world seen from an Aerocene Explorer will be one that is ever-changing and continually stimulating!





# Swift Wind: Hearing Environmental Effect

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Samuel Hertz

*The act of hearing involves the becoming-air of the mechanical aspects of human perception.*

Considering modalities of sound and audition as acts of airborne collaborations necessitates a re-thinking of our model of hearing. This is to say: any idea of hearing as a receptive act must necessarily involve a stage of exterior transmission—the possibility for contact and co-creation with the sound world in which the listener is embedded. In this model, (cochlear or non-cochlear) hearing must be thought of as more than reception, without ignoring that it is one of the senses and ways with which we navigate our physical surroundings. Hearing is not only an extension of our audition (in its reaching outward) but also generative: every heard act is a new instance, an invention of and through mind, ear, and space. In this sense, we never hear one sound; hearing sound from any distance is to say we hear the elapsed history of a sound: the accumulation of effects, noises, and obstacles it

meets in coincidence with one's proximity to its wave trajectories. We never hear exactly one sound in that the concept of a 'single sound' is a processing effect of audition, not any natural province of acoustics. A single sound, or a heard instance, is in fact a bundling of spatio-temporal treatments to and from a sound and the receptive body. To hear accumulations—to hear an environment—is to hear distance and history. It exemplifies the manner in which we simultaneously detect, re-sound, and embody striations of detailed textures and ecologies.

I introduce the term aero-acoustic emissions in order to invoke composer Maryanne Amacher's work in otoacoustic emissions—the physical principle of, and the hyper-polyphonic theories arising out of the production of novel sonic content by the ear—illustrating the conditions of the external territories of bodily perception. Further, 'aero' highlights the airborne nature of perception in Tomás Saraceno's Aerocene project through

examining modalities of being vertical in collaboration with environments and ecological frameworks. My aim here is to work in the domain of the human (to the extent that we can consider this distinction) within this new verticality—to imply that it is the perceiving individual, as well as the sound, that becomes airborne. This thought should prompt both subjective and institutional re-framings of the dynamic relations between humans and environment through perception, affect, and physicality. We become sound differently, and in different ways, we are implicit in the collaborations between spatial, embodied, and atmospheric aspects of sound production and reception.

***How do we perform with air, rather than through it?***

By which I mean, if we are already active in the aero-poietic processes of environmental perception, is there a modality of human hearing that encourages the

development of affective congruences with environments, ecologies, and objects?

Examining infrasound (sound below the threshold of human hearing, ~20hz), as a specific example, allows us to visualize a dense domain of both naturally occurring and human-made sounds, predictive and descriptive of everything from emergent weather patterns to weapon detonations, animal communication networks, or emotional dispositions, such as fear-response mechanisms. It is through these diverse expressions of infrasound that we can begin to grasp the multiple ways in which the human subject is already effectively embedded in this feedback network: in addition to creating the conditions for the amplification of infrasonic information, humans are responsible for the global climate change, expediting deviations in geologic and ecological states.

As a way of complicating the human position within this network, infrasound

Bedard Jr., A.J and Thomas M. Georges. 2000. *Atmospheric Infrasound*. *Physics Today* 53, no. 3: 32-37.

allows a deeper look into the sonorous products of these transformations. Observed rising incidents of suicide rates in areas in the mountain ranges of the Rocky Mountains and the Alps due to low-frequency oscillations indicate a mode in which humans are intricately connected to geophysical systems on the sonorous level (Bedard and Georges 2000).

Might warming climate trends affecting surface configurations of mountain ranges modulate long-range aeolian tones? It is equally conceivable that human industrial activity is either responsible for, or perhaps a mitigating factor of, these affective transmissions. In either case, the spilling-out of sound is always coincidental with the spilling-out of affect. The very idea of 'sound production' as active human process may need to be re-considered; in addition to creating infrasonic atmospheres, humans also generate and modify the conditions for atmospheric and geologic sounding through non-audio processes.

Similarly, we might look backwards in time to the beginning of the era of urban industrialization, speculating as to the effects of increased infrasonic interventions precipitated by the introduction of large-scale factories and the advent of public transportation systems. Is it possible to view historical socio-cultural trends, or map the development and outgrowth of cities, through a lens of infrasonic affect? And what effects might this industrial intervention into new regions of vibratory propagation have had on human social and emotional interactions? These questions are of course unanswerable from the perspective of the past, but in our inability to provide (audio) recordings of these moments we might realize the importance of re-examining history through the lens of our current understandings of infrasonic affect. As smudge studios relates in “Practices for Turning into the Anthropocene,”

Kruse, Jamie and Elizabeth Ellsworth. 2015. *Practices for Turning into the Anthropocene*. In *The Geologic Imagination*, ed. Arie Altena et. al., 2015. Amsterdam: Sonic Acts Press.

**“proof of each practice is that it sets up occasions in which we sense for ourselves some of the ways that we are deeply entangled with dynamic and changing Earth forces at cultural and material boundaries”** (Kruse and Ellsworth 2015).

Material and cultural effects, therefore, stand in relation to flows of environmental affect, and vice versa. Further, we must assume that this relationship is not solely a contemporary one—a historical understanding of this sonic entanglement suggests the existence of more complicated accounts in which direct human influence may not be a primary motivational force. Perhaps then, we might view the Aerocene—our becoming airborne—as a platform for coming into closer intimacy with the feedback loop of affectivity in which humans are already constituted. It is a position from which to sound atmosphere and the human simultaneously, to discover new spectral modes

of human/environmental association. Maryanne Amacher's work suggests the degree to which the spatial and sonorous configurations that we perceive are collaboratively created in association with these very same components, and through the articulation of aero-acoustic emissions I mean to suggest that the next step is to investigate the nodes in which these human/environmental crossings occur. Under what spectral circumstances might we be said to come into coincidence or various states of affectivity with ecological frameworks? The verticality of the Aerocene project is important precisely because it provides a model for engaging with affective environmental sensibilities. In some sense it acts as a sonic filter by eliminating ground noise, and provides an unprecedented look into the realm of atmospheric infrasonics.

As atmospheric infrasound (and infrasonic waves generally) are able to travel much further and for much longer than higher frequency waves, we may return

to the notion that hearing at a distance is hearing the historical trajectory of a sound object. The elapsed history of infrasound might be defined by the magnitude of information potentially 'encoded' within it. The spectrum of the infra and near-infrasonic might therefore reveal a complex polyphony comprised of atmosphere and distance. In the Aerocene project's airborne trajectory, we come closer to sensing these deeper connections—a more nuanced version of the sonic world and sonorous history, which is both above us yet within us concurrently.

One of the important questions asked by the Aerocene project is precisely the same as the question I pose above: how do we perform with air, rather than through it? Reformulating the question to apply directly to Aerocene motion, it might sound something like: how might we be with air, rather than in spite of it? Becoming airborne is a unique opportunity in which to re-compose senses of belonging to, responsibility for, and

intimacy with ecologies: if, as Amacher suggests, we are implicit in the co-creation of environment, so too does the Aerocene suggest that we are implicated in this same environmental co-creation. For too long have we considered human activity to be one based in the overcoming of obstacles, relying on a view of the human body as a pre-composed organism.

A human body with a form quite solid in stature, possessing enough power to re-compose the environment surrounding it, and therefore possessing the ability to form bodies in relation to Capitalist ontology, as well as creating the conditions for a society that can re-produce these same structures. It is precisely this biopolitical construction of the body and its physicality that enables the advance of industrial capitalism and the accompanying forays into noisy, ecological interventions which presuppose clear distinctions between human and environment from the outset (Clough 2010).

Clough, Patricia T. 2010. *The Affective Turn: Political Economy, Biomedicine, and Bodies*. In *The Affect Theory Reader*, ed. Melissa Gregg, Gregory J. Seigworth, 2010. Durham, NC: Duke University Press.

Alternatively, both the Aerocene project and aero-acoustic emissions gesture to the fact that the body must be viewed as a porous entity—as flexible as any environment in which it can exist, and presupposing intimate, consistent, and inextricable exchanges between human and environment. In fact, as the world's space programs have demonstrated, flights into the upper atmosphere contribute to losses in both bone and muscle density—less as a political act of becoming open, the mere fact of verticality implies greater permeability in the 'solid' human form. The further one is from the ground, the more literal space exists within one's constitutive frame. As human organisms create noise, they are affected in turn by these same expressions, and these generative expressions take root to the extent that the human body can be said to be permeable.

In the same vein, human activity in the world based on empirical observations, resultant purely from the standpoint of

that which is perceivable to humans, reduces the positions from which we can be said to 'have knowledge about' any substance.

This relation to perception based in capitalist ontology does not grant the subjectivity of external objects or ecologies: by which I mean the extent to which non-human modes of knowing and perceiving can become animated. To become porous, humans must also allow the expression of these invisibilities to become intelligible—to counteract the notion of any 'whole' perception based purely on the idea that there are multitudes of processes and ecosystems at work, outside of the baseline of human perceptive faculties. To once again invoke infrasound as an example, observing infrasonic productions from various phenomena gives far deeper insight into natural processes through attention to 'hidden' details. Infrasonic recordings of a house fire in Alaska reveal not the process of consumption of the structure by the destructive properties

Szuberla, Curt. *Unheard Soundscapes: The Infrasonic World of Man & Nature*. 2008. Accessed 7 January, 2017. Available from <https://www.youtube.com/watch?v=DjRv0bW6MjY&t=3198s>.

of fire, but the 'breath' of the fire by way of the oscillations produced through the inhalation of oxygen and exhalation of carbon dioxide. (Szuberla 2008) In other words, the 'life' of the fire is described through infrasound, not its relationships to the human realm of property interests. Although this chemical reaction is already understood, framing it in terms of its infrasonic production de-centers the locus of subjectivity to describe 'fire in and of itself' as opposed to a fire for or in spite of humans. Infrasound as a lens or registry of observation allows humans a glimpse into the life and propagation of environmental objects and encourages the flow of affective relations between interacting ecologies.

Most importantly, however, it opens up a space wherein new branches of correlation between human and non-human objects may begin to be experienced. To say that fire 'breathes' is not a tactic of anthropomorphization as a means to create an experience of it that is more



relatable to humans — instead I focus on this idea to complicate the set of relations between the categories. It might be that humans breathe as fire does—through consumption and destruction—or that this ‘breath’ is just one of the ways in which fire and humans are more intricately connected or enmeshed than previously thought.

If we allow that affect, belonging, and intimacy flow freely between environments and humans, and we understand the word as a product of co-composition through ecological modes of relations, then it must be understood that this works not only against Capitalism’s insistence on power based in ‘whole’ structures, but also in the sense that it dislocates objects and environments from being defined by their usefulness as productive resources. What is offered instead is a modality of interaction foregrounded by exchange. Infrasound is but one tool allowing humans to look further than anthropocentric and capitalist ontological

views of environmental relationships, seeing instead objects and ecologies as intertwined and co-dependent gives far deeper insight into natural processes through attention to ‘hidden’ details. Infrasound recordings of a house fire in Alaska reveal not the process of consumption of the structure by the destructive properties of fire, but the ‘breath’ of the fire by way of the oscillations produced through the inhalation of oxygen and exhalation of carbon dioxide. In other words, the ‘life’ of the fire is described through infrasound, not its relationships to the human realm of property interests. Although this chemical reaction is already understood, framing it in terms of its infrasound production de-centers the locus of subjectivity to describe ‘fire in and of itself’ as opposed to a fire for or in spite of humans. Infrasound as a lens or registry of observation allows humans a glimpse into the life and propagation of environmental objects and encourages the flow of affective relations between interacting ecologies.

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The notion of Aerocene also promotes a scaling of perception to the degree of “Earth magnitude.” To conceptualize perception at this level is to “think something seemingly near to us, yet which is in fact more distant than Sagittarius A: human being as such.” That is to say: instead of looking at Earth through the scope of human perception, it is perhaps more beneficial to look at perception through a planetary lens. Timothy Morton suggests that it is precisely this re-framing of thought (and therefore perception) at Earth magnitude that allows for the introduction of the complex and

Morton, Timothy. 2015. *Human Thought at Earth Magnitude*. In *The Geologic Imagination*, ed. Arife Altına et. al., 2015. Amsterdam: Sonic Acts Press.

sometimes contradictory affective flows to pass fluidly between human and environment. Through thinking in these terms, we engage with a process that allows humans to grasp more about ourselves in relation to the ecologies in which we are embedded. We might say that the low frequency vibrations emanating from the mountain-tops are the same swift wind that carries.

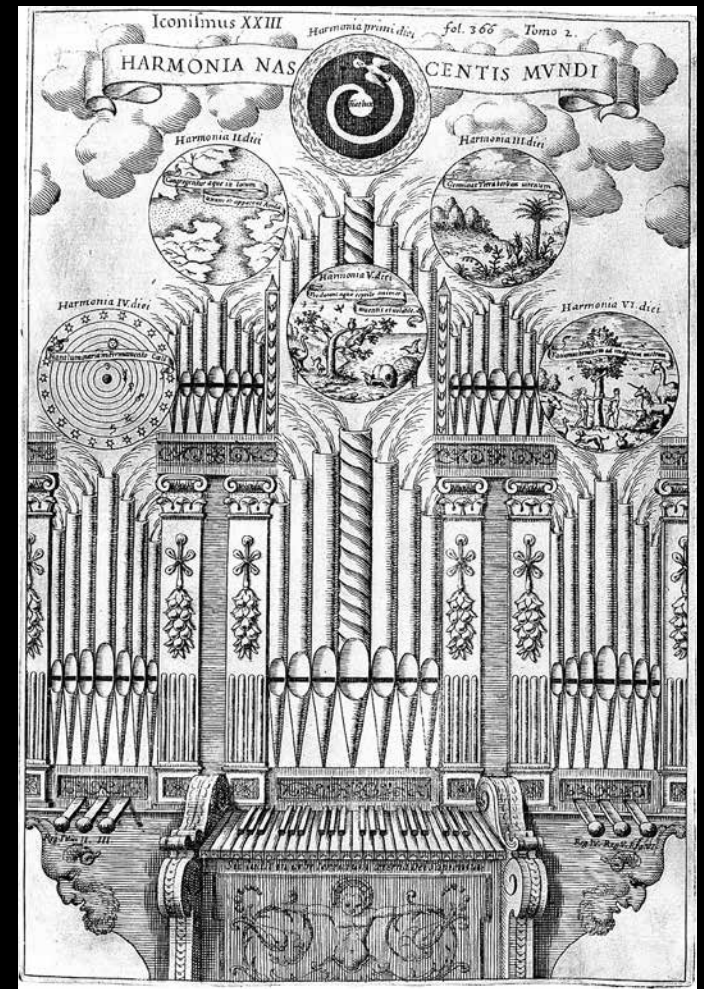
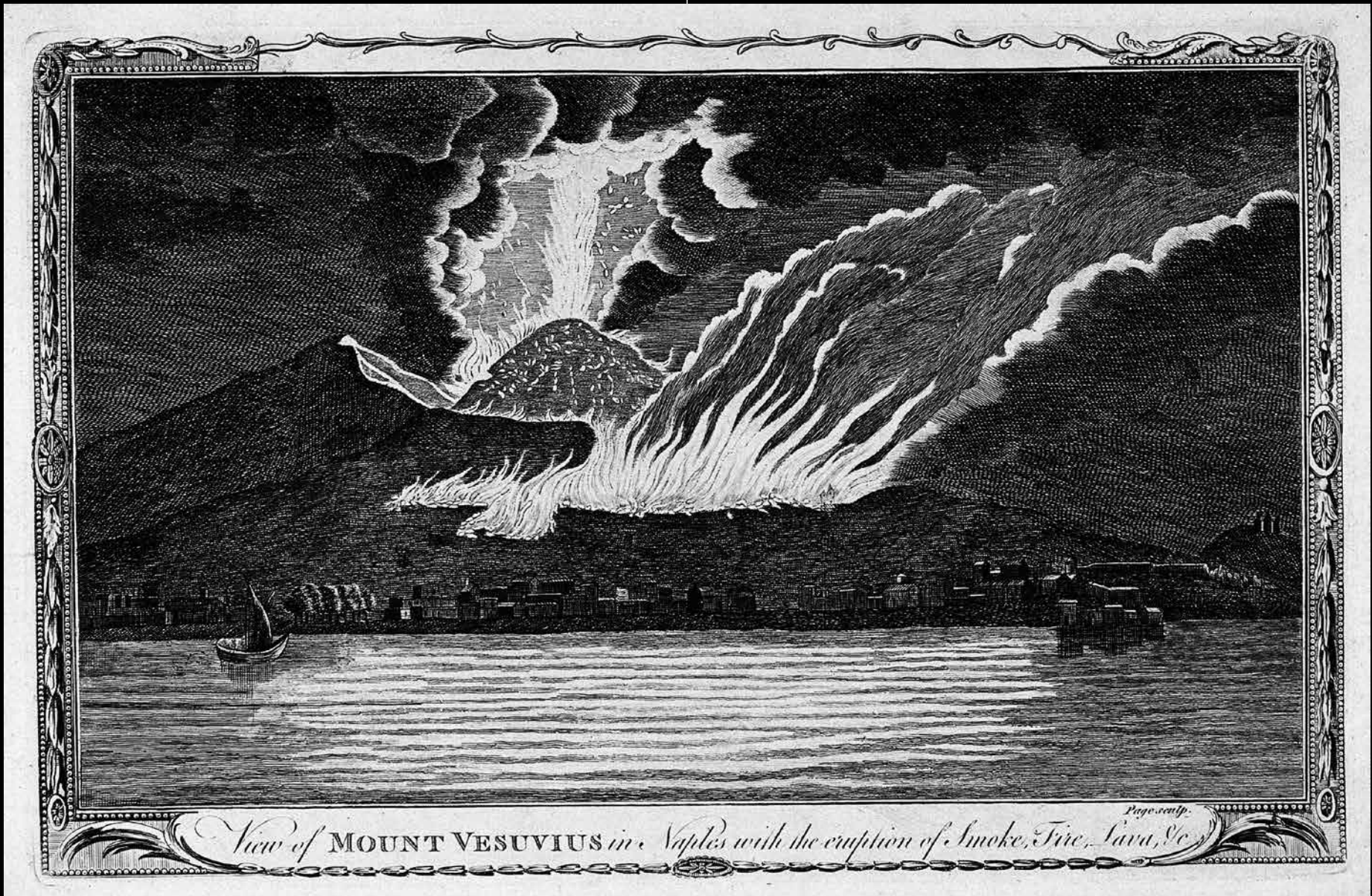


fig. 1



*View of MOUNT VESUVIUS in Naples with the eruption of Smoke, Fire, Lava, &c.* Page sculp.

fig. 2



fig. 3

fig. 1 Athanasius Kircher, *Harmonia Na Centis Mundi/ Musical organ with diagrams*, 1650. Organ with related 'environmental' scenes tied to frequency registers.

fig. 2 Artist Unknown, *Mount Vesuvius by night, erupting with smoke, fire, and lava, with houses on the Bay of Naples*.

fig. 3 Re-production of Richard Dadd's *The Fairy Feller's Master-Stroke*, *OZ Magazine* #33, p. 49.

fig. 4 Crowd of people gathered to listen to music conducted by a man in a hot air balloon.



fig. 4

. . . might  
exist . . .

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Ronald Jones

The first passenger to step off London's inaugural hydrogen balloon flight was a cat. Having lifted off from the Artillery Ground, traveling in a northerly direction, the pilot, Vincent Lunardi, known as "The Daredevil Aeronaut," made an unscheduled "compassion-landing," I would call it, in Welham Green. The cat on board had become terribly airsick. And so, as Lunardi steered the balloon towards the ground, with a degree of gratitude for a lower attitude that we can hardly imagine, Lunardi's cat took the chance and jumped, abandoning Lunardi and his remaining passengers, a dog and caged pigeon. The remaining three lifted off once again, making their way to Standon Green End, where they gently concluded their 24-mile journey. Not only was the cat lost on that maiden voyage in September of 1784, but so too, her name to history, and for that matter, the name of both dog and bird; all three animal-aeronauts, anonymous to this day.

As the result, of the four on board, only Lunardi's name, along with George Biggin, his intended co-pilot, survive to have their place within this inimitable moment, in the history of flight. The crowd that had come to witness the lift-off numbered more than 200,000. Lunardi made his departure, becoming airborne without co-pilot Biggin, who was hopelessly late, trying to snake his way to the launch pad, through the gathered throngs. To take off, leaving Biggin behind, wasn't Lunardi's initiative at all, but rather a command from Royal Ground-Control, so-to-speak. When the pilot learned that none other than the Prince of Wales had grown insufferably impatient to see the balloon lift-off, it did.

On that day discovery was everywhere. The cat "discovered" airsickness for the first time, and Lunardi found fame by discovering that which he once could have only imagined; manned flight, in a balloon, cross-country, was, more or less possible. His achievement was celebrated, and not least by a turn in fashionable trends. His flight triggered the

collective creative class to react directly to the pulse of the Lunardi moment. So-called, "Lunardi skirts" decorated by balloons became the rage, and not a few large balloon-shaped bonnets, as tall as 600 mm, appeared in high society; naturally they became known as "the Lunardi Bonnet." The Scottish national poet Robert Burns reacted to the fad, fame and feat with a poem titled *To a Louse*, where he imagines an ignominious louse finding its home in the splendor of a Lunardi bonnet . . .

*I wad na been surpris'd to spy  
You on an auld wife's flainen toy;  
Or aiblins some bit dubbie boy,  
On's wyliecoat; But Miss' fine  
Lunardi! fye! How daur ye do't?*

## 2

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And now, to serve up the second helping of my story, I'll dial our time machine forward, to just less than a century ahead of the Lunardi balloon flight, to the year 1870. In his popular dictionary from that same year, *Modern Slang, Cant and Vulgar Words*, J.C. Hotten records the word "Albertopolis" as both an imaginative and mischievous name, or as he wrote, the "facetious appellation given by the Londoners to the Kensington Gore district." To be even more pointed, Londoners had begun to call the collection of cultural and educational institutions, gathered on and around Exhibition Road, from the Albert Memorial to the Natural History Museum, "Albertopolis," conjoining the Prince with the Acropolis, that ancient place synonymous with imagination. In turn, Albertopolis absorbed all the resonant meaning this colloquial word-play could radiate. And while this list is not exhaustive, the area of South Kensington is home to Imperial College, the Natural History Museum,

the Royal Albert Hall, the Royal College of Art, the Royal College of Music, the Royal Geographical Society, and the Victoria and Albert Museum. The collective imagination of the arts and sciences had, in a word, produced Albertopolis, a city on a hill that would not be hidden.

## 3

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In the third turn to my short story our hero enters at last. Tomás Saraceno is the benefactor of the story just told, spanning from contemplation—the resolve of Albertopolis, to application—the work of Lunardi. And today, whether Tomás' interdisciplinary practice unfolds at NASA's Ames Research Center, within the Biennale di Venezia, or along London's Exhibition Road, in every case, it is so intentionally fluid as to be, on the one hand, commendably open-ended, while on the other, irresistibly poignant within that precise moment and place in time.



But, please, lets forgo that old dog-eared litany of questions again . . . is he an inventor or scientist?, does he produce art or research?, is he a . . . . .

True enough, it once meant something to pose those questions to Buckminster Fuller, and a few others, but to persist in this manner today is disingenuous, mere nostalgia for an earlier and simpler time. Rather than rehearse these questions, yet again, without the hope to hear any newly relevant answers, let me, in turn, give you an answer without a question. An answer, which I have come to believe, is truer to Tomás' practice than anything I have yet written, or ever read about him. Tomás has realized in his art, what the Albertopolis symbolizes, and as he flies over it, keep that in mind. All there is left for me to say is that his practice, is most productively understood, as an expression of Agnoseology, the philosophy of discovering where the limits of knowledge, perhaps even where the limits of imagination itself, exist.

Ronald Jones

Royal College of Art, Harvard University



fig. 1

**A Cartoon Depicting Balloomania in the 1780s—the Height of Balloon Fashion.**



fig. 2

**Captain Vincenzo Lunardi with his Assistant George Biggin, and Mrs. Letitia Anne Sage, in a Balloon, 1785.**

*TO IMAGINE  
SOMETHING  
IS TO THINK OF  
IT AS POSSIBLY  
BEING SO.*

Alan R. White, *The Language of Imagination* (1990)

# The Promise of Release

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Derek McCormack

Even in germinal, speculative form, Aerocene poses many vital questions. One of the most insistent of these questions concerns the conditions under which it is possible to affirm the event of releasing something into the air. Aerocene is call for us to think about how and why we should devote our conceptual, technical, and ethico-political energies to this event. And in the process, it gives this event a new kind of gravity.

This element of Aerocene is important because the event of release has become more difficult to affirm for a number of reasons, all of which are probably by now quite familiar. To begin, releasing something into the air can be framed as damaging or toxic with respect to the atmosphere and the forms of life that depend upon the precise properties and capacities of its composition.

The overall drift of environmental policy is towards the reduction (as far as possible) of the release of a range of substances and materials into the

atmosphere: the problem of climate change has long been framed in terms of the challenge of scaling back emissions of greenhouse gases. Release is also difficult to affirm because the atmosphere is an increasingly regulated space, governed by a raft of technical, legal, and political agreements governing who, or what, can fly where.

The act of releasing a 'free' craft or device of any size into the air is now subject to a series of restrictions designed primarily to reduce risks to heavier-than-air aviation. More generally, perhaps, in many western industrial societies at least, people are perhaps becoming less and less accustomed to allowing things to drift untethered in the air, and perhaps less willing to value drifting as a legitimate mode of aerial journeying, whether of objects or of humans.

Despite these difficulties, the promise of releasing something into the air remains alluring in all kinds of ways. Certainly, it continues to be the focus of many events

across the world. These events are characterised by various affective tones and tempers. Consider, for instance, the ongoing appeal of the release of lighter-than-air things during events of memorialisation, celebration, or festivals. We might think here, for example, of the release of sky lanterns during events such as the festival of St. John in Porto or the Yi Peng festival in Thailand, as well as during a host of memorial events in many countries. Or we could think of how acts of release often perform a distinctive and powerful role in political demonstrations or protests.

Even if they are increasingly regulated, restricted, and in some cases proscribed, there is a value to events of release that should not and cannot be easily dismissed. The event of releasing something into the air retains the potential to catalyse and distribute collective affects and emotions across various bodies, devices, and forces. By generating atmospheres of informed captivation, such events can

work to produce new spheres of involvement in orbit around important matters of political, social, or cultural concern. In doing so these events can redirect our attention, not only upwards, to the sky, but also towards the very conditions of the milieus in which bodies are enveloped. They remind us that to be released into the atmosphere and to move with its energetic flux is not about forgetting the terrestrial but about finding new elemental forms of being in the air.

This is one of the reasons that Aerocene is such a necessary project: it “re-singularizes” an event which, in many respects, has become too tethered and too domesticated. By this term, borrowed from Felix Guattari (1995), I mean that Aerocene invites and allows us to generate something relatively new within an act that has been rehearsed to the point that it no longer seems able to surprise us. In doing so Aerocene revivifies the promise of release. And it does so by asking us what it might mean to release something

Guattari, Felix. 1995. *Chaosmosis: An ethico-aesthetic paradigm*. trans. Paul Bains and Julian Peñafís. Sydney: Power Publications.

into the air as if it were a gift to the atmosphere rather than something that diminished its capacities. Aerocene is an invitation to participate in the crafting of devices whose release is charged by elemental energies that amplify rather than draw down the powers of the atmosphere. This participation is sustained by different forms of collaboration defined by own atmospheres of involvement: the moment of release becomes a relatively still point sustained by a wider ecology of practices including fabrication, inflation, and tracking.

Aerocene re-singularises the promise of release by allowing us to experiment and speculate with concepts and craft for extending our capacities to make more of the elemental conditions that sustain diverse forms of life. At the centre of this promise is a cluster of distinctive entities that can harness the elemental energy of the sun and the earth in order to take flight. These entities are important in drawing collective attention to the

elemental conditions of the air. But the significance of Aerocene goes beyond the speculative capacities of these particular things: Aerocene—given shape in the form of various solar sculptures—renews the promise of any careful act of release. It is about the radical distribution of the promise of this act.

It enjoins us to experiment with the possibility that at whatever scale, and whenever we sense and feel the circumstances are right, acts of release can become catalytic events for expanding and intensifying the envelopes of our atmospheric being.



fig. 1

Picture of release of balloons for Gibraltar National Day, 2001.



fig. 2

Francisco Goya, *La Cometa*, 1778.



fig. 3

Balloons released into the air during the Israel-Jordan Peace Treaty signing ceremony at the Arava Terminal. 1994.

## Biographies

**Peter Adey** is Professor of Geography at *Royal Holloway University* in London. His work lies at the intersection between space, security and mobility, and the blurring boundaries between Cultural and Political Geography. Pete's research has revolved around themes of the 'new mobilities paradigm'; vertical and military geographies; emergency, evacuation and the future of mobility; and the matter of air and atmosphere. Pete's first book was titled *Mobility* (published with Routledge in 2009) and he has since co-edited the *Handbook*

*of Mobilities* (Routledge, 2014) with David Bissell, Kevin Hannam, Peter Merriman and Mimi Sheller, and is co-editor of the *Changing Mobilities* book series with Monika Busher. Pete has been the recipient of fellowships from the *ESRC* and *AHRC*, standard grants from the *EPSRC/AHRC*, *ESRC*, *Agence National de la Recherche*, the *Leverhulme Trust* and a visiting fellowship from *UCL*.

**Sasha Engelmann** is Lecturer in Geo-Humanities at *Royal Holloway University*,

London. Her work explores the poetics and politics of air through collaborations with artists and other practitioners. In recent years she carried out ethnographic fieldwork at Studio Tomás Saraceno in Berlin, participated in the development of the *Aerocene* project, and developed a new curriculum for creative practice in the Anthropocene with Tomás Saraceno, Jol Thomson, Ivana Franke, Natalija Miodragovic and Alan Prohm at the *Technical University of Braunschweig*. She holds a DPhil in Geography and the Environment from the *University of Oxford*. On the radio waves, her callsign is *M6IOR*.

**Harriet Hawkins'** research is focused on the advancement of the *GeoHumanities*, a field that sits at the intersection of geographical scholarship with arts and humanities scholarship and practice. Empirically she explores the geographies of art works and art worlds. Collaboration underpins her research practice and alongside written research she has produced artist's books, participatory art projects and exhibitions with individual artists and range of international arts organizations including *Tate*, *Arts Catalyst*, *Iniva*, *Furtherfield* and *Swiss Artists in Labs*. Harriet is the author of *For Creative Geographies* (Routledge

2013) and *Creativity* (Routledge 2016), co-editor of *Geographical Aesthetics* (Ashgate 2014). She is the Deputy Director of *HARC (Humanities and Arts Research Centre)* and Co-Director of the *Royal Holloway Centre for the GeoHumanities*.

**Samuel Hertz** is a Berlin-based composer, researcher, and curator working at the intersections of psychoacoustics and expanded listening practices through electro-acoustic works, live electronics, collaborations with performance companies, and essays. He received his MFA at *Mills College*, studying composition

with Pauline Oliveros, Fred Frith, and Zeena Parkins, and producing/performing with Morton Subotnick. His work has recently been performed in France, Germany, and Belgium, as well as *Center for New Music, BAM/PFA, Gray Area Foundation for the Arts, and Harvestworks (USA)*, among others. He was a Composer-in-residence at *Elektronmusikstudion (SE)*, and is currently DARE Artistic Research Fellow with the University of Leeds and Opera North. [samhertz-sound.com](http://samhertz-sound.com)

**Sir Brian Hoskins**, CBE, FRS is currently part-time Chair of the *Grantham Institute* at

*Imperial College London* and Research Professor in Meteorology at the *University of Reading*. He is also a member of the *UK Committee on Climate Change*. Until his retirement in April 2014, Sir Brian had been Professor of Meteorology at *Reading* for more than 30 years and was the founding Director of the *Grantham Institute*. He held a Royal Society Research Professorship from 2000 to 2010. He was a Review Editor and an Author in the *Intergovernmental Panel for Climate Change Fourth Assessment Report*. He served as Vice-Chair of the *Joint Scientific Committee of the World Climate*

*Research Programme* from 2000 to 2004. He was President of the *International Association of Meteorology and Atmospheric Sciences* from 1991 to 1995. For many years he was Chairman of the *Met Office Scientific Advisory Group* and he was also a Non-Executive Director of it. Professor Hoskins was trained in mathematics at the *University of Cambridge* and his research has been on the understanding of weather systems and climate processes. He is a member of the *Scientific Academies of the UK, USA and China*. He has received the top awards of the *UK and USA Meteorological Societies* and is an



honorary member of them. He has recently been awarded the *Buys Ballot Medal* and the inaugural *Gold Medal of IUGG*. He has honorary degrees from Bristol and UEA, and is an Honorary Fellow of *Trinity Hall*, Cambridge. In 2007, he was knighted for *Services to Environmental Science*.

### **Ronald Jones**

is Senior Tutor at the *Royal College of Art* in London, serves on the faculty of the *Graduate School of Design, Harvard University* and has been named a Fellow at the *d-School*, Paris. He is a member of the *Nobel Foundation's Science and Humanities Program Committee*.

He holds the Ph.D. in Interdisciplinary Studies from *Ohio University*, and a Certificate from the *Harvard University Graduate School of Education*. A participant with NASA's *Lunar Reconnaissance Orbiter Camera investigation*, he assesses the significance and value of Exploration and its visual representation within a broad historical context. He is represented by *Metro Pictures* in New York.

His work as an artist is in the permanent collections of numerous international museums including *Tate Modern*, the *Museum of Modern Art* in New York and the *Moderna Museet*, Stockholm.

**Anne Jungblut** is a researcher in the *Life Sciences Department of the Natural History Museum*, London with particular focus on diversity, evolution and ecology of polar cyanobacteria, microbial mats, toxic cyanobacteria and polar soils. Current projects of her research group include: 1) *Diversity and distribution patterns of polar cyanobacteria along ecozones and latitudinal and environmental gradients*; 2) *Study of cyanobacteria and photosynthetic microbial mats in Antarctic lakes to understand microbialite formation and responds to environmental change*; 3) *Using historic and Antarctic herbarium*

*collections to study cyanobacteria*; 4) *Microbial soil biogeography in the Southern Atlantic: South Georgia and the Falkland Islands*, 5) *The Microverse: a UK-wide citizen science project on eDNA assessment of microbial diversity in urban environments*.

### **Andreas Philippopoulos-Mihalopoulos,**

LLB, LLM, PhD, is Professor of Law & Theory at the *University of Westminster*, and founder and Director of *The Westminster Law & Theory Lab*. His interests are typically interdisciplinary, including space, corporeality, new materialism, and philosophy.

Andreas also pursues an art practice under the name of picpoet. Edited volumes include *Law and the City* (2007), *Law and Ecology* (2012), *Luhmann Observed: Radical Theoretical Encounters* (2013), and with Augusto Cusinato *Knowledge-Creating Milieus in Europe* (2015). He has published three monographs, *Absent Environments* (2007), *Niklas Luhmann: Law, Justice, Society* (2010), and *Spatial Justice: Body, Lawscape, Atmosphere* (2014). Andreas is the editor (with Christian Borch) of the *Routledge Glasshouse* series *Space, Materiality and the Normative*.

**Carlo Rizzo** is an independent curator, researcher and art adviser. He is the founding director and programme curator of the Exhibition Road Commission and a researcher at the Victoria & Albert Museum focusing on the museum's collection of international contemporary art and design. Carlo runs an independent advisory practice helping public and private organisations in London develop cultural strategies and new interdisciplinary partnerships. He also serves on the board of the Royal British Society of Sculptors as a trustee since 2015. Prior to launching the Exhibition

Road Commission, Carlo was a member of the Science Museum management team and worked on several strategic assignments including setting up the Science Museum Foundation and the redevelopment of the Mathematics Gallery and Medicine Galleries. Prior to the Science Museum, he worked in the department of the Near and Middle East at the British Museum, supporting the development of their contemporary art collection. Carlo's career started in financial services, with roles at the Bank of England and— as a strategy consultant— in several financial institutions across the UK and Europe.

**Tomás Saraceno's** oeuvre could be seen as an ongoing research, informed by the worlds of art, architecture, natural sciences and engineering; his floating sculptures and interactive installations propose and explore new, sustainable ways of inhabiting and sensing the environment. He has initiated many collaborations with renowned scientific institutions, including the *Massachusetts Institute of Technology (MIT)*, the *Centre Nationale des Études Spatiales* and the *Max Planck Institute*. Saraceno also achieved the world record of the first and longest certified fully-solar flight, lifting a dozen of people in *White Sands* desert with *D-O*

AEC sculpture without a drop of fuel, without solar panels or batteries, and without any artificially produced gases. His work has been exhibited internationally.

**Bronislaw Szerszynski**

is Reader in *Sociology at Lancaster University*, UK. His research combines approaches from the social and natural sciences, arts and humanities in order to situate the changing relationship between humans, environment and technology in the longer perspective of human and planetary history. He is author of *Nature, Technology and the Sacred* (2005), and co-editor of *Nature Performed* (2003), *Technofutures*

(2015) and a special double issue of *Theory Culture and Society* on 'Changing Climates' (2010). He was also co-organiser of the public events *Between Nature: Explorations in Ecology and Performance* (Lancaster, 2000), *Experimentality* (Lancaster/Manchester/London, 2009-10), and *Anthropocene Monument* (Toulouse, 2014-2015).

**Holger Thüs** is Senior Curator (Lichens & Myxogastria) at *The Natural History Museum*, London, Life Sciences Division. His research interests are focused on the ecology and evolution of amphibious lichens, bioindication and the

conservation of lichenised fungi and their associated algae. His curatorial work covers the management and development of one of the world's largest collections of lichens, lichenicolous fungi (species parasiting on lichens) and slime moulds (Myxogastria) with a total of approx. 450,000 specimens. A small number of non-lichenised fungi and the possibly earliest scientifically accurate collection of models of fungi by J.Sowerby are also curated in this section. Holger is coordinating a project to enhance conservation and access to our non-incorporated collections (backlogs) across the *Botanical Collections Team*.

See more at: [www.nhm.ac.uk/ourscience/departments-and-staff/staff-directory/holger-thues.html#sthash.LKJ0lu1i.dpuf](http://www.nhm.ac.uk/ourscience/departments-and-staff/staff-directory/holger-thues.html#sthash.LKJ0lu1i.dpuf)

**Derek McCormack**

is an Associate Professor of Human Geography at the *School of Geography and Environment, University of Oxford*. He has written extensively about geographies of affective experience, performance, and atmospheres. He is the author of *Refrains for Moving Bodies: Experience and Experiment in Affective Spaces* (Duke University Press) and the forthcoming *Atmospheric Things: The Allure of Elemental Envelopment*, also with Duke.

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# Colophon

**The Aerocene Foundation—initiated by artist Tomás Saraceno—is a non-profit organisation devoted to community building, scientific research, artistic experience, and education.**

**The Foundation works with artists, thinkers, scientists, researchers, balloonists, technologists, humanitarian workers, influencers and visionaries to increase public awareness of global resource circulation, and reactivate a common imaginary towards new symbiotic relationships with the earth.**

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