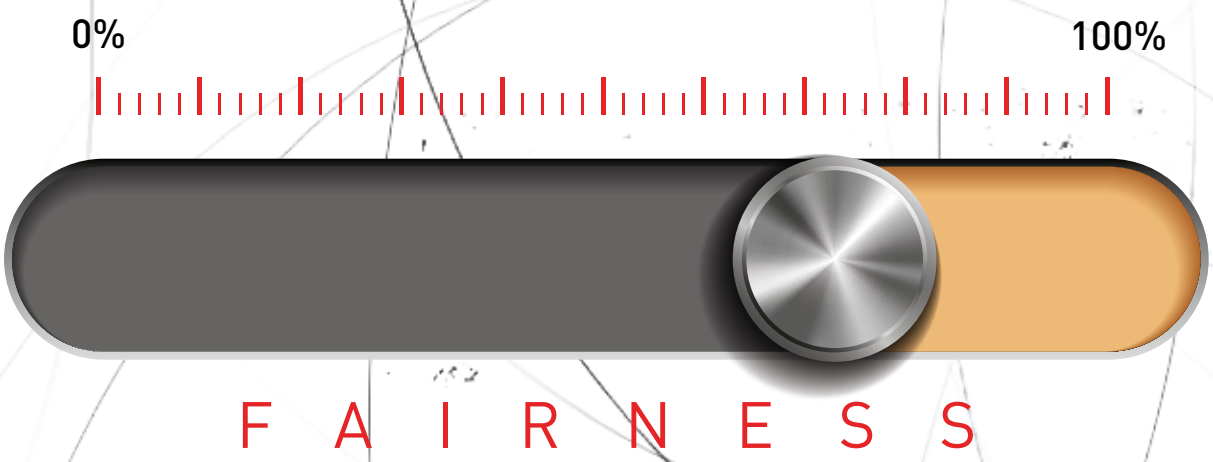
FAIR

RESONANCES II



Sixty years ago in Rome, the foundations were laid for the Europe that we know today, ushering in the longest period of peace in its written history. The Treaties of Rome have established a common market where people, goods, services and capital can move freely and created the conditions for prosperity and stability for European citizens.

On this anniversary, Europe looks back with pride and forward with hope. For 60 years we have built a Union that promotes peaceful cooperation, respect for human dignity, liberty, democracy, equality and solidarity among European nations and peoples. Europe's shared and better future is now ours to design.

ORGANISERS

The European Commission is the EU's politically independent executive arm. It is alone responsible for drawing up proposals for new European legislation, and it implements the decisions of the European Parliament and the Council of the EU.

From the European Commission web site

As the European Commission's science and knowledge service, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle. Its work has a direct impact on the lives of citizens by contributing with its research outcomes to a healthy and safe environment, secure energy supplies, sustainable mobility and consumer health and safety.

From JRC Science Hub web site

National Museum of Science and Technology Leonardo da Vinci
We are the largest museum of science and technology in Italy, one of the most important ones in Europe and in the world. We keep up-to-date and experiment new languages to communicate new stories and to engage new publics. We valorize the largest collection of machines models in the world, realized basing on Leonardo da Vinci's drawings. We work to be Europe's leaders in Informal Education.

From the site of the National Museum of Science and Technology

SciArt
In its simplest definition, SciArt is art inspired by science and art made with scientific concepts, tools and materials.
[for the JRC,] SciArt presents itself as a major shift in the way art engages with science, opening new avenues of collaboration and reciprocal stimulus. Art can help scientists and policy makers not to lose sight of the big picture, as it can help to unlock new avenues of research.

From the JRC SciArt Strategy Report

DEFINITION

fairness, n.

Brit. /ˈfɛːnəs/, U.S. /ˈfɛrnəs/
Forms: see FAIR *adj*. and *n*. and -NESS *suffix*; also eOE **fegeirnis** (*Mercian* ...
Frequency (in current use):
Origin: A word inherited from Germanic.
Etymology: Cognate with or formed similarly to Old High German *fagarnessī* ...

1.a. Beauty; attractiveness. Now somewhat *arch*. and *literary*.
(a) As an abstract quality. Now rare.
(b) As an attribute of a person, part of the body, or occasionally an animal.
(c) As an attribute of a thing or place.
†b. A beautiful thing, feature, or ornament. *Obs*.

2. With reference to speech: the quality of being polished, elegant, or well expressed; eloquence. *rare* in later use.

†3. Courtesy. *Obs*.

†4. Gentleness; kindness. Sometimes contrasted with *foulness*. Only in **by fairness, with fairness**: by gentle or kind means. *Obs*.

5. With reference to the weather: the state or condition of being free from rain, wind, etc.; pleasantness, fineness. In early use also with reference to the sun: †brightness, brilliance (*obs*.). Now somewhat *arch*. and *literary*.

6. Honesty; impartiality, equitableness, justness; fair dealing.

7. Lightness in colour of complexion, skin, or hair; paleness; blondness.

fairness, n. OED Online. Oxford University Press, June 2017. Web. 17 August 2017.

ABOUT

This book is a snapshot of the road the Joint Research Centre set out to follow bringing together art, science and society. It shows the experimental character and uncertainties of our endeavour, sometimes the divergences of opinions or the difficulties of working with different frames of mind – or should we say different bodies of knowledge? It is the voice of those that were willing to share with us the challenge to chart unknown territory and that resonated with the ideas we wanted to investigate. It seems correct that this book reflects this experimental character and respects those voices. The snazzy layout does not hide the diversity of approaches, the variety of styles and the inevitable frictions of coming to terms with different disciplines. It is the beginning of a journey; a journey towards a true democracy of disciplines.

This book is thus a sketchbook: it illustrates the creative process in bringing together artists, scientists and administrators. A temporary brief of an exciting adventure. We hope we can continue going further and beyond.

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Fair/Fear

AN ATTEMPT TO ADDRESS A MATTER OF CONCERN

Now tell me this: if it's the work of injustice, wherever it is, to implant hatred, then, when injustice comes into being, both among free men and slaves, will it not also cause them to hate one another and to form factions, and to be unable to accomplish anything in common with one another?

Plato, The Republic, *351d-e*

Indeed, the distribution of wealth … is of interest to everyone, and that is a good thing.

T. Piketty, Capital in the Twenty-first Century, *p. 2*

THE CONTEXT

Too many people are angry. Too many people perceive society as unfair. The failures and excesses of today's economies continue to lead to social and environmental degradation.

More than one third of young adults in Southern Europe remain without a job, and people die in multi-storey buildings because safety regulations were deemed too expensive. Nature reserves and holy lands are sacrificed for greed and profit. The last primeval forest in Europe is being given away for industrial activities. People go hungry in one part of the world, while food is wasted and thrown away in others. The richer countries have played the greatest role in causing climate change but it is the poorer ones where the impacts are suffered most. But even in the Western world, poverty-stricken city dwellers will be stuck and agonise in their ever-sweltering cities, while the better-off will escape to the coolness of their mountain cabins. Masses of civilians suffer the consequences of wars that are started by a few. Terror hits the innocent and leaves everybody wounded.

People's anger is easily turned into fear by populists ready to find scapegoats for things gone wrong. Leaders challenge values that were taken for granted. Democracy is challenged. Thinking global and acting local has been replaced by simply thinking local. The world seems to be in turmoil.

In the clamour of press titles and fake news, we must not forget that turmoil is a continuous element of history. It forces societies to change course. Like previous crises, the current one obliges us to rethink and change, to adapt and refine our policies. In order to reach out.

Turmoil
is a continuous
element of history.

The JRC
inserted fairness
in its Strategy 2030
as one of three
"broad dimensions",
together with
competitiveness
and resilience.

THE REACTION

Adapt, refine, reach out. That is what the Joint Research Centre (JRC), the science and knowledge service of the European Commission, attempts with the Fair/Fear exhibition. Fairness is one of the most important themes of the European Commission. In his opening statement to the European Parliament in 2014, President Juncker reflects on Europe's response to the financial crisis: "Mistakes were made". "There was a lack of social fairness. Democratic legitimacy suffered as many new instruments had to be created outside the legal framework of the European Union"[1]. Taking stock of the political guidelines of the Juncker Commission, the JRC inserted fairness in its *Strategy 2030* as one of three "broad dimensions", together with competitiveness and resilience, which reflect the EU's long-standing aim to create a prosperous social market economy[2].

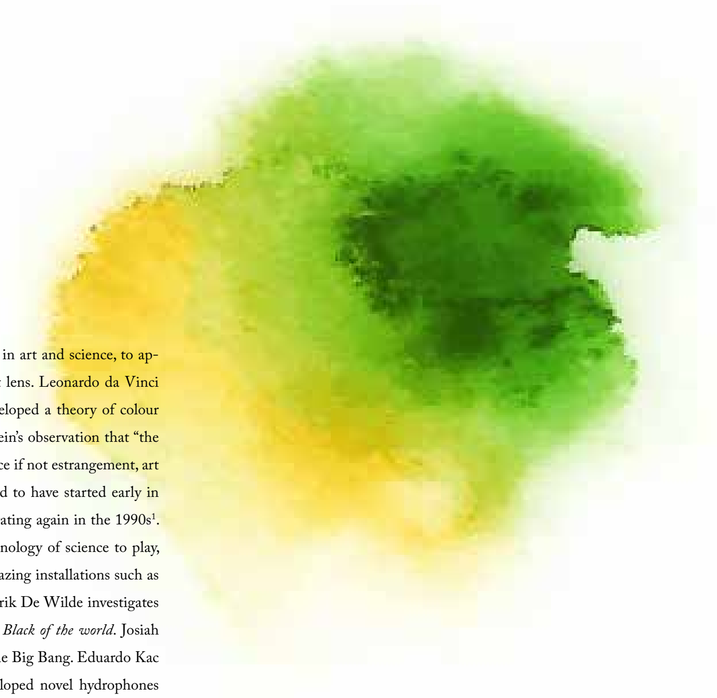
The JRC is a unique research institution, in that its scientific research is directed towards support of the Commission's policies. It is a dynamic place where researchers from Europe and the world meet to define common approaches for all Member States, develop standards applicable in all countries, spur innovation, and strengthen the research networks in Europe and beyond.

The JRC puts its multi-disciplinary research at the service of the policymakers and thus, of the European citizen[3]. Sociologists, economists, and statisticians study the multi-faceted subject of fairness. A first result is the report *What makes a fair society*[4]. The starting point of the report is "… the anger currently felt by too many of our fellow citizens." And the question is raised: "whether a rising sense of unfairness may be fuelling it"[5]. The report continues: "There are always people who feel that society is unfair but, today, there are simply too many of them. Why is this? What has gone wrong? How can our political leaders fashion a set of policies which will deliver a society in which a sufficient number of people at least believe, to be sufficiently fair?"[6] From the very beginning, the report defines fairness as intrinsically subjective, passionately felt by everyone. It is a complex subject, analysed and tackled from many different angles and by different approaches. The report looks at fairness from two main axes – inequality of income and inequality of opportunity. It examines the spatial dimension of fairness, which is extremely important in a Union of 28 countries. Finally, the report produces some intriguing insights as to the issue of perceptions and attitudes towards Fairness.

1 J.-C. Juncker, *A New Start for Europe: My Agenda for Jobs, Growth, Fairness and Democratic Change, Political Guidelines for the next European Commission, Opening Statement in the European Parliament Plenary Session*, recovered in May 2017 at https://ec.europa.eu/commission/publications/president-junckers-political-guidelines_en.
2 *JRC Strategy 2030*, [Brussels], 2016, p. 14, see https://ec.europa.eu/jrc/sites/jrcsh/files/jrc-strategy-2030_en.pdf, recovered in May 2017.
3 For more information on the JRC, see the JRC Science Hub at https://ec.europa.eu/jrc/en.
4 *What Makes a Fair Society, Insights and Evidence, JRC Report*, [Brussels], 2017, recovered in May 2017.
5 Id., p. 5.
6 Id.

After centuries of relative distance if not estrangement, art and science seem to be converging again.

SCIENCE AND ART



Adapt, refine, reach out. Two years ago, the JRC initiated an activity in art and science, to appraise its research and support to policy-making through a different lens. Leonardo da Vinci practiced anatomy to understand how to draw muscles. Goethe developed a theory of colour and did excellent work as a botanist; others might be aware of Einstein's observation that "the greatest scientists are artists as well". After centuries of relative distance if not estrangement, art and science seem to be converging again. This confluence can be said to have started early in the twentieth century, becoming stronger since the 1950s and accelerating again in the 1990s[1]. Today artists are increasingly taking up the ideas as well as the technology of science to play, create, astonish and question. They kindle curiosity by developing amazing installations such as Olafur Eliasson's Sun in the Tate Gallery (*The Weather Project*). Frederik De Wilde investigates the microscopic by playing with nanoparticles to make the *Blackest Black of the world*. Josiah McElheny examines the macroscopic by making glass sculptures of the Big Bang. Eduardo Kac has produced flowers with human DNA and Jana Windersen developed novel hydrophones to capture the sounds of coral reefs. At the same time, images from the Hubble telescope and from the Atlas detector at CERN bring a new kind of beauty into our homes. In fact, for some, science has taken over a narrative of beauty and wonder that art has left behind.[2] Yet art is investigating new possibilities given by science, while scientists search for innovative and creative ways to communicate their work to society. The French sociologist/philosopher Bruno Latour, very active on the borders of science and art, has indicated the need to become more *real* (with science), to be more *true* (with art), to become more *present* (with politics), if we are to tackle the global challenges we are confronted with. Latour expresses a strong conviction, shared by many, that only by bringing together artists, scientists and citizens we can hope to find answers to the collective problems of our time.

The JRC has started a project, SciArt, that investigates this movement of reconciliation coming from the arts as well as the sciences, trying to understand if it is a real, epochal change. Can it help organisations, such as the JRC, to interact with the public and find common ground? It hopes in this way to create a dynamic connection between research, policy making, and the people it serves. Real innovation can only come when all parties come out of their comfort zone and move again into the agora of public participation. We think that art and science will continue their reconciliation but only on condition that they approach each other with open minds, even with humility, in what we call "a democracy of disciplines". The real experiment we are undertaking is to see how a work of art can be inspired by science and the policy making it supports at the JRC. Does this bring the triad of art, science and society closer again? Can these works communicate better with the public, helping the JRC and by extension, the European Commission, to adapt, refine, reach out?

1 See, e.g., Miller, Arthur I., *Colliding Worlds, How Cutting-edge Science is redefining Modern Art*, New York, W. W. Norton, 2014; Strosberg, Eliane, *Art and Science*, New York – London, Abbeville Press Publishers, Second edition, 2015; Wilson, Stephen, *Art + Science Now*, London, Thames and Hudson, 2010.
2 See Siân, Ede, o.c., p. 1.

These are all difficult questions, and science has as yet no unequivocal answer, which makes it rich territory to be explored by artists working with scientists.

A sense of fairness predates humanity and is shared by all higher mammals.

FAIR AND FEAR

Fairness often reveals itself when it is absent or negated. Confronted with its negation, we all still react like the Capuchin monkey of the Dutch primatologist and ethologist Frans de Waal. His small experiment has been seen more than 11 million times on YouTube but we nevertheless show it in the Fair/Fear exhibition[1]. Two monkeys get different compensation for the same task, the first getting a piece of cucumber, the second getting a grape. The one that gets the less tasty treat, seeing the other being treated differently, becomes angry. She throws the cucumber back to the researcher. She is clearly upset walking nervously around in her small space, then she rattles her cage and glares at her colleague. She cannot speak and she does not shout – but her body language is more than eloquent. We understand her immediately: she has been treated unfairly[2].

Frans de Waal and other primatologists have concluded that a sense of fairness predates humanity and is shared by all higher mammals. An interesting proposition that seems to clash with our common belief that fairness is first and foremost product of civilisation.

We refer to the rich philosophical tradition of fairness and justice that goes from Plato and Aristotle, through medieval philosophers, over Hobbes and Hume, to Kant and John Stuart Mill. And in the last decades fundamental works have been published such as John Rawls' *A Theory of Justice* of 1971, and Amartya Sen's *The Idea of Justice* of 2009. Recent years have also seen a stimulating and innovative debate on fairness and justice, with ramifications into philosophy, political theory and economy. Put in practice, the actions of the UN Development Programme achieved historical results, such as the halving of poverty as set by the Millennium Development Goals[3]. Such very positive results remain largely below the threshold of collective attention because of the rumble of political strife and the sirens of fake news. Yet they are important, making a difference to the lives of billions of people.

But fairness goes beyond mere thought: it stirs our emotions. Like the Capuchin monkeys, we become upset when we are treated unfairly or when we witnes unfair treatment.

What is the first emotional reaction to unfairness? The thought of justice? Or do we act like an animal attacked by a predator – flee, hide, or fight, following a process of emotions and behavioural corrections as those triggered by fear and inscribed in our DNA? Or can we also think? Do we first get angry, and does prolonged anger transpose into fear? Is it fear that generates anger, or vice-versa?

These are all difficult questions, and science has as yet no unequivocal answer, which makes it rich territory to be explored by artists working with scientists. We chose the coupling of Fair/Fear: "Fair" and Fear" are two faces of the same coin, where the absence of one implies the presence of the other.

1 See https://www.youtube.com/watch?v=meiU6TxysCg, visible at installation 01 The Thinker by Frederik De Wilde. For the full TED Talk, see https://www.ted.com/talks/frans_de_waal_do_animals_have_morals.
2 In the full TED talk and in other books and articles, De Waal describes how, in certain occasions, primates in the second role (of receiving a grape) refuse the grape until the first monkey gets one, too. This, for De Waal and other primatologists, establishes that these primates share a concept of fairness. On the debate between De Waal and philosophers and science writers, see De Waal, F., *Primates and Philosophers: How Morality Evolved*, Princeton: Princeton University Press, 2016.
3 World Bank, *Global Monitoring Report 2015/2016, Development Goals in an Era of Demographic Change*, Washington, 2016, p. 32.

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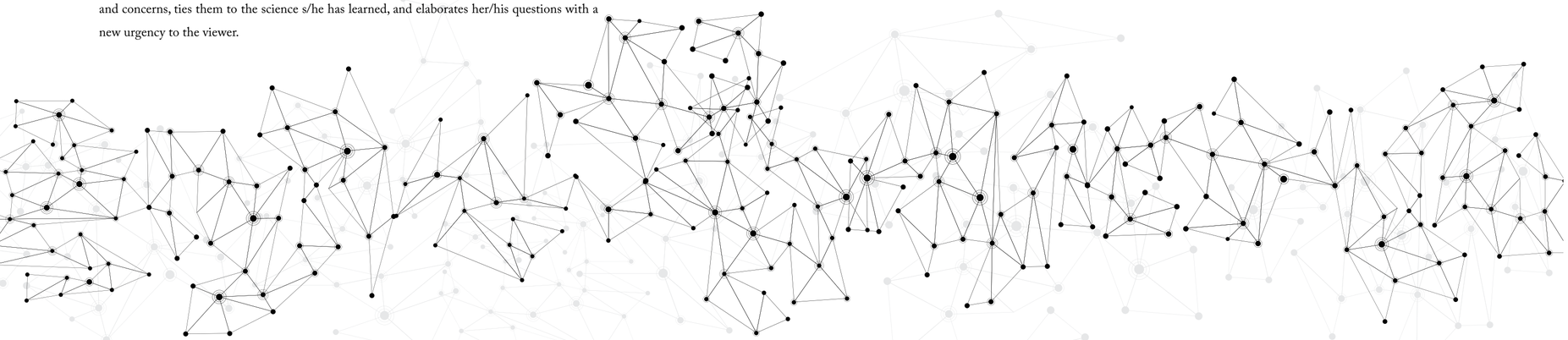
RESONATING ABOUT FAIRNESS

Adapt, refine, reach out. The Resonances Festival (and the exhibition it opens) is the flagship of the SciArt activity. It builds on the first Resonances Festival, on Food, that was held in Milan in October 2015, in the frame of the EXPO2105[1].

To prepare for this year's Festival, and to investigate the rich territory of the meaning of Fairness and Fear, a Summer School with scientists, policy makers, and artists took place at the JRC in the summer of 2016. Each artist participated in scientific briefings, discussing and questioning them. In dialogues with the scientists they made proposals for a works/installations, making fairness visible in often surprising or oblique ways.

In total, 31 proposals for art installations or performances were made. 16 were selected by a panel composed of members of the SciArt team and distinguished art-science experts[2].

The selected exhibits touch upon five domains: society, economy, nature/environment, science and the cosmos. Often these domains morph into one another, society moving into economy and economy touching upon nature. These are the Resonances – strictly plural! – that SciArt invokes. Between these domains, they evince an intertwined world where borders fade away and society influences nature like art can influence science. Each artist follows his/her own specialty and concerns, ties them to the science s/he has learned, and elaborates her/his questions with a new urgency to the viewer.



1 JRC, *Resonances I, Food*, Brussels, 2017.
2 Members of the JRC Artistic Expert Board and jury are: Peter Weibel, CEO of the Zentrum für Kunst und Medientechnologie (ZKM) Karlsruhe; Michael John Gorman, founding director of Science Gallery (Dublin) and Biotopia (Munich); Ariane Koek, founding director of Arts At CERN (Switzerland) and from September 2017 Science Gallery Venice (Italy); A.I. Miller, Emeritus Professor of History and Philosophy of Science at University College London (UK); and Mariele Neudecker, artist who works across arts and science and Professor in Fine Art at Bath Spa University (UK).

THE EXHIBITION

In ***Society***, we look into some primal fears that permeate modern life. We touch upon societal trends such as transhumanism and human morphing. Working with JRC philosophers, toxicologists, media scientists and demographers, artists like Frederik De Wilde, Markus Zohner and Lorenzo Montanini question our future. What will we repair in our bodies and how fair is that? How is migration changing our society? Fabio Cian shows the resilience of the school children of the Tacloban catastrophe and asks the visitor: *what is your dream?* Alan Alpenfelt, who ties the entire exhibition together with his *Secret Sound Stories*, points at the importance of our own personal stories when judging fairness.

In ***Economy***, some have taken up the challenge of discussing the economic aspects of unfairness. Looking at global inequality, Fabio Lattanzi Antinori asks: Can the economy be fair? *How do you distribute?* The couple Honey & Bunny (Martin Haeblesreiter and Sonja Stummerer) question our food habits and the consequences of industrial food production. JRC scientists Davy Vanham and Luc Feyen look at the water footprint of a typical meal and how it differs between continents. How can our eating habits be fair? *How much water do we eat?*

In ***Nature***, we touch upon "our fair sister' and her travails. We look into air pollution and find it will not respect borders. Anaïs Tondeur makes pictures of beautiful albeit polluted cloudscapes from Scotland to Paris, working with JRC air quality scientists to interpret them. We watch the unfolding disaster of the *Xyllella bacterium*, killing olive trees in Puglia: with Matteo Pizzolante and the JRC *xyllella* research group we ask what more will globalisation disrupt? Singer-songwriter Mario Costanzi confronts us with natural disasters such as a flood, an earthquake, a volcanic eruption. The SciArt couple Dmitry Gelfand and Evelina Domnitch team up with sculptor Kim De Ruysscher to make the installation *Double Ocean*. Working on the dwindling currents of the Earth's Oceans, they ask: *where will we stop*?

We turn to ***Science*** to see what she has to offer. Frederik De Wilde asks: *who do you hurt?* He 3D prints Mickey Morph, part of an on-going bio-mass project, investigating with JRC toxicologists the possibility of eliminating animal trials completely. And AnneMarie Maes presents her on-going project on wild bees. She calls upon science and art to help the bees survive. *What do you cure*?

In the end, we turn to the ***Cosmos***. We have invited Dmitry Gelfand and Evelina Domnitch to show their *Memory Vapour*, a SciArt repeat of the experiment proving the existence of cosmic radiation. It is an eerily beautiful installation that raises the question *Who will remember*? It is an invitation to look up to the heavens and contemplate the preceding stories of fair and unfair without fear, from a perspective where our emotions can recede before the awe-inspiring greatness of the cosmos.

ENGAGING WITH FAIRNESS

Our installations are spread over the *Museo Nazionale della Scienza e della Tecnologia Leonardo da Vinci* in Milan (National Museum for Science and Technology Leonardo da Vinci) and in its Olona space. They are connected through a loose narrative that starts from our fears and our dreams for the future, and then moves on to investigate our money, our food and the water we consume. From an excursus into the possibilities of modern medicine we move on to questioning the earthquakes provoked by the activities of man. This brings us to science, showing a negative effect of science on lab animals, but also the possibilities of rigorous research to cure these effects, working with bees. Trying to alert our kids to the inevitability of disasters seems the right thing to do, but the overwhelming effects of floods, droughts and earthquakes cannot hide that nature is sometimes dying, as are the olive groves in Apulia. Looking at more suffering of nature in the oceans, the cosmos is the last place where we can put our questions to rest.

Yet, in the museum that describes itself as the "museum of the world's becoming", the orderly sequence described above is jumbled as an appropriate symbol of the random character of fairness itself, and of the themes our artists, supported by the scientists, have chosen to work on. It is in the end like hopscotch – a game of fairness, jumping and leaping from one theme to another. We therefore devised a hopscotch game for visitors, going through all levels, answering the questions raised by each installation, and, in the end, winning a small prize if all questions are answered – the two faces of the coin fair/fear spinning around its axis. The answers will be used by the JRC to understand what the public, in particular children, think of fairness.

We cannot escape the subjective nature of fairness. It concerns us all and everyone has his/her own partial view of fairness, determined by his/her place in family, work, and society[1]. It is this subjective nature of fairness that adds a personal and emotional component to fairness, even if, collectively, we need to engage in objective, evidence-based study of its multifaceted character. As the *Fairness Report* points out, too many people think life is unfair. Charles Dickens already observed in *Great Expectations*: "In the little world in which children have their existence, whosoever brings them up, there is nothing so finely perceived and finely felt, as injustice[2]". This is why the JRC is very pleased to have the opportunity to show the Resonances Exhibition "Fair/Fear" in the Science Museum of Milan, which addresses us all, but in particular children and young students.

It is these children who will continue to work towards a fairer society, and we need to instil in them the ideal, whether it be hidden in our genes or invented by civilisation. Unfairness needs to be redressed: fairness is worth striving for.

In the
little world
in which children
have their existence,
whosoever brings them up,
there is nothing so finely
perceived and finely felt,
as injustice.

1 Or in the beautiful phrasing of T. Piketty: *Peasant and noble, worker and factory owner, waiter and banker: each has his or her own unique vantage point and sees important aspects of how other people live and what relations of power and domination exist between social groups, and these observations shape each person's judgment of what is and is not just. hence there will always be a fundamentally subjective and psychological dimension to inequality, which inevitably gives rise to political conflict that no purportedly scientific analysis can alleviate. Democracy will never be supplanted by a republic of experts – and that is a good thing.* T. Piketty, *Capital in the Twenty-First Century*, Cambridge, Mass. – London: The Belknap Press of Harvard University Press, 2014 (2013), p. 2.

2 Dickens, C., *Great Expectations*, The Bath Press, 1997.

CITIZENSCOPE

Much has been said about fairness; it is everywhere from political discourse through to academic and media discourses, in policy development, civic action and mundane achievements… This encounter of arts and science about fairness is another journey into exploring together this concept: what are the meanings that entrench those global political discourses? What is the resonance of such discourses with different publics? Are there spaces for citizens (and non-citizens) to appropriate those meanings, make sense of them and eventually get empowered to engage in daily action about fairness? Engaging citizens in societal issues through purposeful organised settings generally seeks to bring forth their insights, expectations and imaginaries into policy and scientific spheres, ultimately speaking to democratic ideals. Resonances II is an opportunity to each of us to engage with concepts and discourses about fairness. Indeed, how would this exhibition be complete if no space were created to have artists and scientists engage, in different interactive ways, with all those who come to explore it and make meaning of it all?

We sought three different ways to collect your insights, imaginaries and opinions about this arts-science project on fairness. In the end, your contribution will form the 17th installation of this journey…

HOPSCOTCH The hopscotch path will be a means to allow the younger audience to navigate through the works of the exhibition. The discovery of the proposed themes and the reflection on the questions related to them will lead to their contribution to the FEAR/FAIR theme. The children can identify within the works tangible points to their own realities and transpose them into a visual representation that will be at once individual and collective. They can use traditional materials such as pen and paper or link their contribution to social media, e.g. Facebook or Instagram.

FAIRAPP Another means of engaging with the public will be the invitation to engage in a participatory project on fairness, where the members of the public are invited, in a playful manner, to make meaning of the works in the exhibition, and how this meaning has changed by visiting this exhibition. Through an App that contains a series of sliders, the visitor will be able to indicate their views for each installation with regards to fairness. He/She can so become part of the vast research project on Fairness that the JRC will undertake in the coming years, of which this exhibition is one of the first steps.

THE 17TH INSTALLATION Participants are asked to take pictures of striking details of the installations that remind them of "fairness" or "unfairness". Participants are subsequently asked to post these pictures using the Fair App, where they can add a caption to the picture: a word or short sentence that encapsulates the reason why it got their attention.

These photos will be automatically shown in what we called the 17th installation, i.e. one that is made by the citizens that will also be in display at the exhibition.

FAIRNESS REPORT. EXECUTIVE SUMMARY

This report takes as its starting point the anger currently felt by too many of our fellow citizens. It asks whether a rising sense of unfairness may be fuelling it.

There are always people who feel that society is unfair but, today, there are simply too many of them. Why is this? What has gone wrong? How can our political leaders fashion a set of policies which will deliver a society which sufficient numbers of people at least believe to be sufficiently fair?

This report is novel in three ways:

Firstly, it acknowledges that fairness is subjective. All human beings care passionately about it. But they have very different ways of defining it. This has been demonstrated by behavioural science research.

So, rather than imposing an arbitrary definition of fairness, the report examines different possible angles.

It tackles both income inequality and equality of opportunity – because people will have different views as to their relative importance. It reveals some, frankly shocking, facts, for example:

- Income inequality has increased markedly in many EU countries since the mid-1980s. This development is mainly due to a broadening between the top and the bottom earners. From mid-1980s to 2008, the average annual real disposable income of the richest 10% increased more than 2.5 faster than that of the poorest 10%.
- Individuals who have at least one tertiary educated parent have twice the chance to reach tertiary education themselves.
- Individuals whose parents have not achieved tertiary education have significantly lower literacy and numeracy scores. Those who are also first or second generation immigrants and who report bad health fare even worse.
- Individuals with a poor family background are more likely to smoke or be overweight or obese than their counterparts from a privileged family background and they are less likely to have exercised in the past seven days.
- The chances of reporting poor health for those with a poor family background are almost 110% higher than for respondents with a privileged family background, even when biological dimensions (age and gender) are accounted for.
- Almost half (44.5%) of the EU population has insufficient skills to participate in the digital economy and society. Seventeen Member States have rates higher than this.

This report acknowledges that fairness is subjective. All human beings care passionately about it.

The more people agree that income differences are too large in their country, the more they want governments to take action to reduce them.

Secondly, it incorporates the spatial dimension of fairness. It finds great heterogeneity, not just across Member States but regions too. There are large spatial disparities in terms of income, income inequality, unemployment, the share of people with tertiary education and access to basic services. This shows that a serious investigation of fairness must therefore focus on the sub-national level. Working solely with national averages is dangerous because it risks failing to spot major disparities within countries. It also risks failing to address reasons for the popular discontent. This is visible across the developed world (and maybe other countries too), suggesting some common themes. At the same time, the reasons for it are likely to vary from one place to another.

Finally, the report explicitly tackles the issue of perceptions and attitudes.

It produces some intriguing insights:

- There is some evidence that people over-estimate income differences. However, data from 2009 indicate that concern about inequality does mirror measured inequality, at least to some extent.
- Perceived inequality is a driver of individuals' attitudes towards redistribution. The more people agree that income differences are too large in their country, the more they want governments to take action to reduce them.
- They are more likely to tolerate income inequality if they perceive there to be a high degree of equality of opportunity (though this attitude is most prevalent in the US).
- Popular perceptions of inequality of opportunity are only weakly linked to objective measures of the same phenomenon.
- Inequality can result from good or bad luck (rather than effort or opportunity). Attitudes to this kind of inequality are influenced by culture.
- Perceptions of fairness are highly influenced by reference points. People base their fairness judgment of the outcome of a given behaviour at least partly on comparisons with the situations of others or situations that occurred in the past.
- It may be that people in countries or regions use different points of comparison. This could explain why, although different regions have undergone changes in different directions, populist disaffection is on the rise everywhere.
- People do not only care about 'distributive justice' (the share of resources or opportunities they get) but also how the decision was taken (i.e. 'procedural justice').

FREDERIK DE WILDE
IN COLLABORATION WITH PHILOSOPHER NICOLE DEWANDRE

Hyper Thinker #1

01

AND YOU, WHAT DO YOU FEAR?

RESONANCES

Technological progress comes with the promise of a more fulfilling life. But now it seems to threaten us with powers that we do not fully understand. The lines are blurring, between real and virtual, between artificial and intelligent, online even when we are offline. It is a world of hyper: a hyper-world of hyper-connections. But where are we, defined by our friends and connections, when connection disappears, afloat in a void? How hyper would Rodin's Thinker *be in the twenty-first century? Would he be afraid? And you, What do you fear?*

FREDERIK DE WILDE

IN COLLABORATION WITH PHILOSOPHER NICOLE DEWANDRE

01

ART

INSTALLATION

Towards a *21st Century Thinker* is an artistic crossover R&D project seeking to explore the ways in which the digital and physical worlds have merged to create an entangled hybrid reality that encompasses us globally, and now offers a new model, new aesthetics with new consequences and new organisation. The research project specifically targets artificial brain and artificial intelligence research, the impact of technology and automation in our society, the role of philosophy and ethics in an increasingly hyperconnected, hyperautomated and technological, hyper-micro-managed, hyperpolarised, … world.

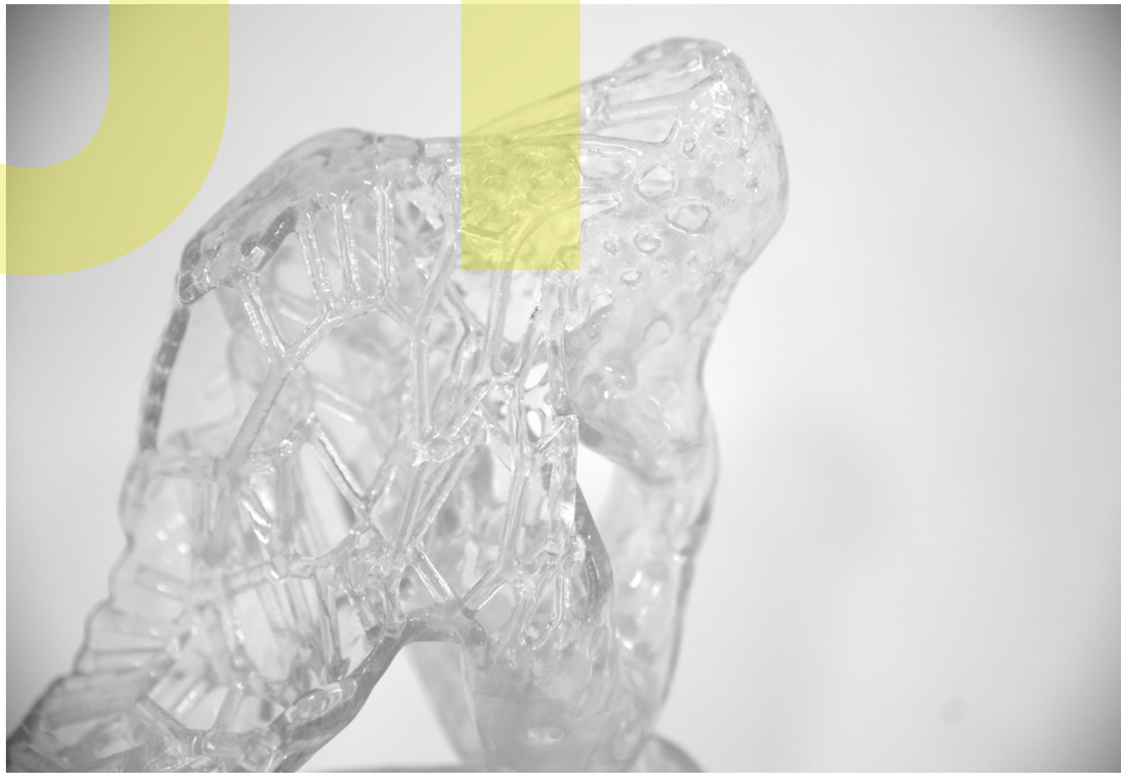
The artwork is inspired by the iconic sculpture *The Thinker* by Rodin that portrays a nude male figure in deep contemplation. De Wilde wondered: "What is The Thinker thinking NOW? What would a 21st Century Thinker look, feel and think like?" Thinking is a solitary activity that we do on our own – solipsistic would be the right word: it absorbs us completely. Yet, as thinkers, we are also plural and relational in our online and offline lives. *HyperThinker #1* exposes our hyperconnectivity by the subversive act of jamming GSM and wifi networks in the vicinity of the artwork, hence critically questioning the nature of the radical shifts that hyperconnectivity imposes on the human condition; e.g. is it fair that the artist doesn't allow us to instantly tweet, post a picture or receive phone calls that distract from experiencing the artwork? And, by extension, is it unfair that many people still don't have access to Internet?

With the ubiquitous access to internet and the expansion of connectivity to objects, there is a radical expansion of the connectivity realm. This radical expansion of connectivity destabilises in profound ways the modern conceptual frameworks on which policy-making continues to rely, implicitly and explicitly. *HyperThinker #1* critically questions the nature of these radical shifts that hyperconnectivity imposes on the human condition also in relation to fairness (e.g. inclusion vs exclusion, access vs non-access, …).

HyperThinker # 1 – "Without Form and Void"

Many ancient cultures viewed the afterlife as a subterranean place where departed souls go after death, a dark dusty, murky, bodiless and joyless existence in the netherworld. Others spoke of the void as being "cast into outer darkness" or "into a bottomless pit". Both are apt images of the void. There are many ways to approach this topic. The one chosen here is to pose a question about August Rodin's famous sculpture, *The Thinker*.

As thinkers,
we are also plural
and relational in our
online and offline lives.



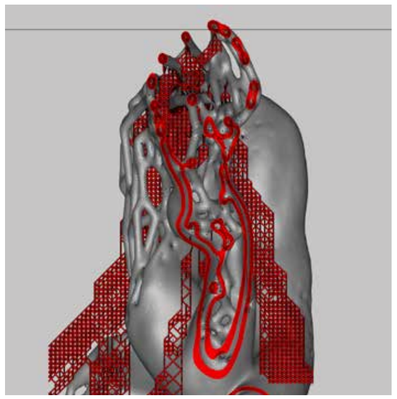
The irresistible question that arises is: what is the Thinker thinking about?
Does he meditate on the infinite expanding universe; or, perhaps, is he pondering Plato's eternal verities: Goodness, Truth, and Beauty? Or maybe he is just trying to remember where he left his keys. Therefore, *The HyperThinker #1* contemplates the emptiness and hopelessness of life lived inside the void. De Wilde is fascinated by the concept of the void which stretches throughout his oeuvre. During the realisation of *The HyperThinker #1 – "Without Form and Void"*, De Wilde discovered a little-known fact concerning *The Thinker* by Rodin - namely that the Cleveland's cast of *The Thinker* was victim of a terrorist attack on 24 March 1970. Unidentified bombers strapped what is suspected to have been three sticks of dynamite to its base. The explosion blew off *The Thinker's* feet and irreparably damaged the legs. The sculpture is still on exhibit, though it has not been restored. De Wilde's *HyperThinker #1* makes a subtle reference to this particular terrorist attack by presenting a Thinker with a missing leg.

Deliberate destruction of cultural heritage is perennial. Contemporary examples include the violent attacks by in Palmyra. At least 28 historical religious buildings and numerous artefacts in Iraq were plundered and destroyed - all inheritance of Iraqi people and humanity. It has to be noted that some of the destroyed artefacts were plaster replicas.

In the era of hyperconnectivity deliberate destruction of cultural heritage doesn't limit itself to the physical and globalised world – but expands also into the realm of the digital. *The HyperThinker #1 – "Without Form and Void"* researches and questions this hyper(dis)connectivity from the perspective of fairness.

FREDERIK DE WILDE

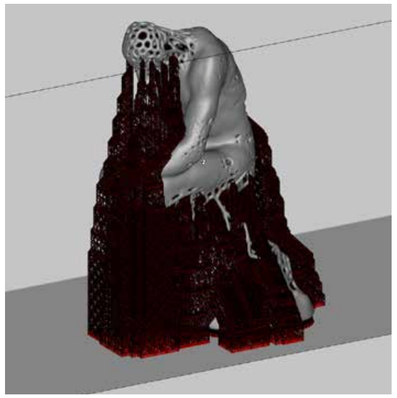
IN COLLABORATION WITH PHILOSOPHER NICOLE DEWANDRE

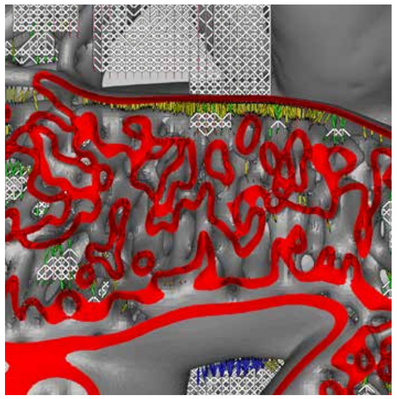


Language has
widespread implications
for our perception
of reality.

SCIENCE BEHIND

NICOLE DEWANDRE





The way we use language has widespread implications for our perception of reality because it ultimately shapes the way we think about and act in the world. This also applies to institutions such as the European Commission. Analysing the language of the EC policy documents over the period ranging from 1984 until 2014, Nicole Dewandre's research aims at unveiling the implicit assumptions underlying the language of EU policy-making, when it focuses on competitiveness, growth, and jobs. The findings provide robust evidence that the EU policy-making is stuck in Modernity and would benefit from embracing an alternative conceptual framework, drawing inspiration from the implicitly post-modern political thinker Hannah Arendt.

This alternative conceptual framework is fit for the purpose in a hyperconnected era characterised by ubiquitous computing. The rational subject, obsessed by control, has to give way to the relational self, aware of his or her inherent vulnerability and relationality as a human being. Control remains important, but instead of being hegemonic, it is to be completed with fairness and resilience, to resonate with the human condition, characterised by biology, worldliness, birthing and plurality. It also requires enriching our approach to relationships, i.e. moving beyond the hegemony of causality and comparisons, and acknowledging the revelatory character of identities that are at play in political interactions.

The cooperation with Frederick De Wilde took the form of a series of conversations, both oral and written, in Ispra and in Brussels. Frederick's interest for the *Onlife Initiative* and the figure of the relational self has been a wonderful opportunity for Nicole Dewandre to clarify and dig deeper into the relations between hyperconnectivity and neo-liberalism, between reality and representations thereof, between the different imaginaries underlying art, science fiction, and politics.

Frederick De Wilde's *HyperThinker* invites each of us to …think… about what it is to be human in the 21st century. Let's stay away from the fear or fascination – which, by the way, form two sides of the same coin – we often develop for artefacts. Politics and policies only make sense if they are human-centric, and this human-centricity entails also our inherent interdependence on each other and on our surroundings. This is why freedom is not about autonomy, but about resonances.

01

Freedom
is not about
autonomy,
but about resonances.

BIOGRAPHY

Frederik De Wilde *(Belgium, 1975) works at the interstice of art, science, and technology. Frederik studied fine arts, media arts, and philosophy. The conceptual crux of his artistic praxis are the notions of the inaudible, intangible, and invisible. An excellent example is the conceptualisation and creation of the* Blackest-Black, *art made in collaboration with American universities and NASA. The project received the Ars Electronica Next Idea Award and the Best European Collaboration Award between an artist and scientist, extensively covered (e.g. Huffington post, Creators Project, TED). In 2017 De Wilde brings the* Blackest-Black art *to the Moon in collaboration with Carnegie Mellon (www.moonarts.org/about/team), NASA, Astro-Robotic and Space-X. De Wilde is a laureate and member of the Royal Belgian Young Academy (www.jongeacademie.be), is currently guest professor at the Artscience Interfaculty in Den Hague, collaborating with the University of Leuven (Prometheus, division of Skeletal Tissue Engineering), collaborating with Hasselt University (I-BioStat), Ghent University (Textile Department), and many other universities (e.g. Wyoming University) and organisations (e.g. ESTEC and the Max Planck Institute). De Wilde is currently finishing his first short film supported by the Flanders Audiovisual Fund (www.vaf.be/toegekende-steun/hoarder), produced by Potemkino, Bekke Films, Radiator Sales and post-produced by The Fridge. Studio De Wilde is currently represented by White Circle Agency (www.whitecircle.xyz) and Sedition (www.seditionart.com).*

Nicole Dewandre *studied applied physics engineering and economics at the Catholic University of Louvain (UCL, Belgium), operations research at the University of California (Berkeley) and philosophy at the Free University of Brussels (ULB, Belgium). She is the author of "Critique de la raison administrative. Pour une Europe ironiste", published by* Editions du Seuil *in Paris in 2002. (collection "l'Ordre Philosophique").*
Earlier in her career, she was advisor to the Director-General of the Information Society and Media Directorate General, European Commission, for the societal dimension of the Digital Single Market - the Commission's strategy to deliver social and economic benefits through ICT. Before that, she was Head of Unit in DG Research to promote gender equality in research, to foster the science and society dialogue and to enhance the alignment of EU-funded research with sustainable development goals.

What's your dream?

02

WHAT DO YOU DREAM?

RESONANCES

A young researcher visits the city of Tacloban, devastated after the passage of Typhoon Haiyan. He finds a small school that has been totally destroyed and talks to the children. They tell him of their dreams, displaying a resilience that denies the unfairness of their plight. What do they want to become when they grew up? Dokto, Avroad, Arkitec. Their dreams continue to exist despite everything being wiped out around them. And you, what do you dream?

FABIO CIAN

A CLIMATE RESEARCHER'S JOURNEY INTO PHOTOGRAPHY





ART
INSTALLATION

I could not stop seeing
myself in their eyes.
Full of joy, life, dreams.

When I met the children at the school or in the slum of Tacloban City, I could not stop seeing myself in their eyes. Full of joy, life, dreams. I grew up on the other side of the world, in a rich country, speaking a different language, with a different culture. But with the same eyes.

On 8 November 2013, the super-typhoon Haiyan, one of the strongest on record with winds exceeding 300 km/h, hit Southeast Asia, in particular the Philippines. It washed away the city of Tacloban on the Leyte Island in the eastern Visayas, Philippines. It caused tremendous damage - more than 6,000 people were killed, thousands of homes were destroyed, over 14 million Filipinos, including nearly 6 million children, were affected. The event had a huge resonance in the climate change community, which happened to be gathered at the time in Warsaw for the COP 19[1]. The Philippine delegate, Yeb Sano, held a touching talk that was broadcasted worldwide. In tears, he told the word about the devastation brought by the typhoon and asked those present to take action.

I had just started my PhD in Science and Management of Climate Change, investigating disasters and their impacts in relation to climate change. I was feeling the urge to experience first-hand, to see with my own eyes what my research was about. A few weeks later, I found myself with a ticket to Tacloban and finally, in July 2014, I joined International Disaster Volunteers, a small NGO that had been operating in the field since the start of the disaster. I took my camera with me and, through the viewfinder, I documented my impressions on the typhoon, how it affected the Philippines, its people, their lives and their dreams, on how climate change can affect our lives. I helped rebuild a school, working as bricklayer among hundreds of children. Some of them had lost their parents, friends, relatives, and homes. During the heavy rains of another typhoon that occurred that month, I served food to soaked children that had nothing but the air they breathed. I could not avoid seeing my childhood in their eyes, comparing my dreams with theirs. On one of my last days there, with a thousand thoughts in my head about the climate, our future, their dreams, I reached the Lun Tad school in Palo, few kilometres south of Tacloban. I entered the crowded Grade II classroom and wrote on the blackboard: "What's your dream?". I collected the childrens' answers and took their portraits, some of them shown here.

1 19th Conference Of the Parties of the United Nation Framework Convention for Climate Change, held in Warsaw from November 11 to November 23 2013.

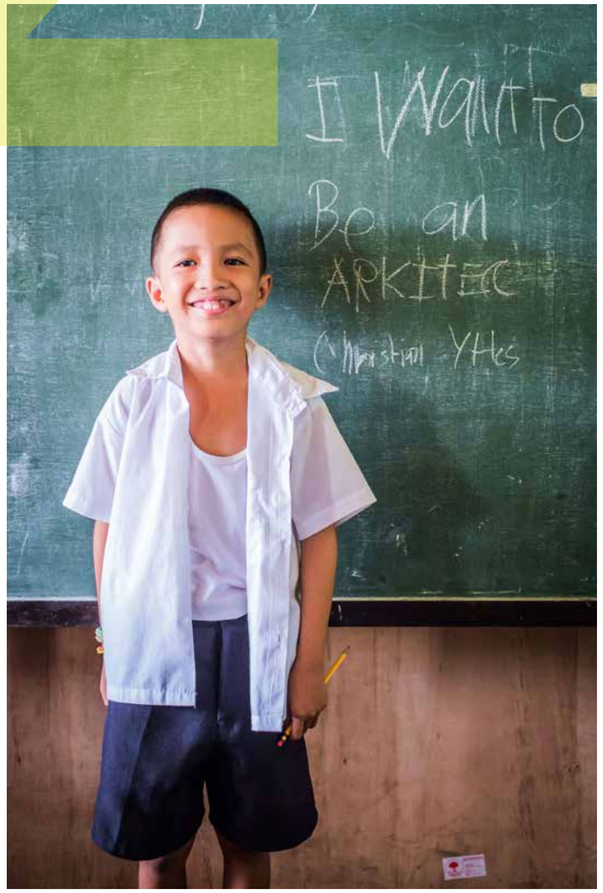
02

"I want to be ovrod" (abroad), "Doktor", "Teacher", "Pulis" (policeman), "attorney", "arkitec" (architect), "I want to work in a bank". I wanted to draw a trajectory, my past and my dreams when I was a child, our present and their dreams, their future. I wanted them to have something where they could recognise themselves, and for me something to remember what my research is about. It is about people and their dreams on a great planet.

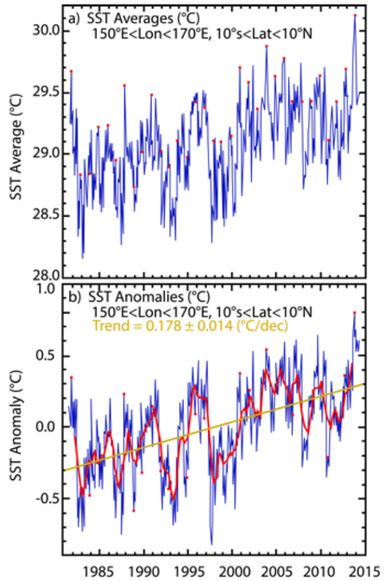
I have been given the chance to follow my aspirations, my dreams, my desire of knowledge. What about them? Growing up in a developing country, with a climate that is changing, where impacts may be more difficult to face, where extreme events may become normality?

With this project, I want to remind my adult self that there are different realities, but with common origins. These eyes and dreams constitute the human species, which is just one of the millions sharing space on this planet. Understanding this trajectory is what fairness means to me.

With this work, I also wanted to remind to my scientist self of the reason why I decided to take this road, to become a scientist. I received a lot from the people I met on my path since I was a child. If I can, I would like to give something back. This is what fairness means to me.



My past and
my dreams when
I was a child,
our present and their dreams,
their future.



SCIENCE BEHIND

TYPHOON HAIYAN AND CLIMATE CHANGE

The relationship between extreme events, such as typhoon Haiyan (the most destructive in the history of the Philippines with more than $ 2 billion in damage), and global warming, is not entirely clear. However, there seems to be a consensus in the scientific community that a warmer surface of the ocean may increase the intensity and the capacity for destruction of typhoons. The sea surface temperature and the amount of water vapour in the air are among the most important factors determining the strength of a typhoon.

In November 2013, in the Western Pacific region and in the Pacific Warm Pool Region – the hottest oceanic sector globally, where most typhoons that hit the Philippines originate – recorded the highest surface temperatures in the period 1981-2014: 30.1°C. October and December 2013 also marked temperatures above the average, indicating an exceptional persistent heat of the surface of the ocean. This could explain the formation of one of the most powerful typhoons ever recorded, with winds up to 378 km/h and a record-breaking advancing speed of 41 km/h. A typhoon that caused a storm surge with a rise of water level up to 7 meters in Tacloban, leaving more than 6,000 people dead and 28,000 wounded.

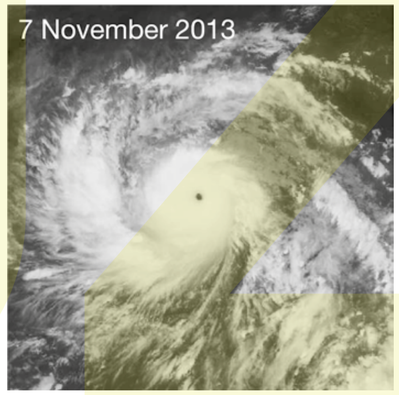
It can easily be seen in the Figure that only few months in the 1980s and 1990s had average water temperatures above 29.2 °C, but there are many such months after year 2000.[1]

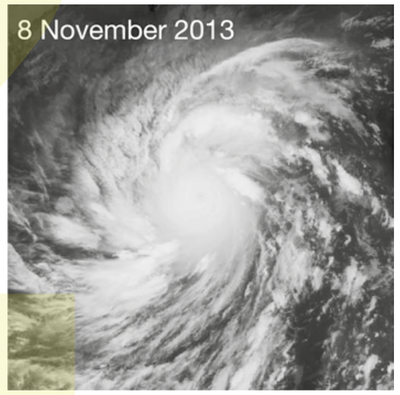
In these two areas, increments of sea surface temperature of about 0.2°C per decade were recorded as well as an increase in the annual minimum temperature, an element that suggests an increase in the temperature of the mixed layer, another factor determining the strength of a typhoon.

The higher sea surface temperature could account for more intensive typhoons in the last decade compared to the previous ones. In fact, between 2004 and 2013, 42% of typhoons that hit the Philippines had winds speed over 150 km/h (67 out of 160), compared to 29% (50 out of 169) between 1984 and 1993 and 30.5% (43 out of 141) between 1994 and 2003.

The sea surface temperature, therefore, shows a good correlation with historical data on the wind speeds of typhoons that hit the Philippines. When the strongest typhoons were formed in this area, sea surface temperature has marked the highest values. This suggests that, with the rising trend expected from ocean temperatures, events like Haiyan in the future may occur more frequently.

> One of the most powerful typhoons ever recorded, with winds up to 378 km/h and a record-breaking advancing speed of 41 km/h.





It is easy to understand how difficult it is to face phenomena of this magnitude. In managing such a risk, it is crucial to consider wind speeds to build sufficiently resistant structures as well as to take into account the extent of possible storm surges, as happened in the case of Haiyan. In addition, a high speed of advancement requires more promptness from alerting systems and civil protection interventions and, therefore, extremely efficient evacuation plans to reduce the number of human and economic losses[2,3,4,5].

There are still studies, however, that indicate that an increase in the sea surface temperature will not necessarily lead to an increase in the frequency of extreme events like Haiyan[6].

Nonetheless, I like to recall Yeb Sano's talk, Philippines delegate at the United Nations Climate Change Conference (COP19), held in Warsaw three days after the disaster, who said that although we cannot directly attribute the super typhoon Haiyan to climate change, we must avoid a future where super typhoons are the normality. We must achieve Article 2 of the United Nation Framework Convention on Climate Change (UNFCCC), i.e., we must prevent human actions from interacting dangerously with the climate of the Earth[7].

1 Figure with thanks to Comiso, Josefino C., Perez, Gay Jane P., Stock, Larry V. 'Enhanced Pacific Ocean Sea Surface Temperature and Its Relation to Typhoon Haiyan', *J Environ Sci Manag*, Vol. 18, No. 1, pp. 1-10.
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3 TAKAGI H., ESTEBAN M., 2016, 'Statistics of tropical cyclone landfalls in the Philippines: unusual characteristics of 2013 Typhoon Haiyan'. *Natural Hazards* 80(1):211-222.
4 MORIN. et al., 2014 - 'Local amplification of storm surge by Super Typhoon Haiyan in Leyte Gulf'. *Geophys. Res. Lett.*, 41(14):5106-5113.
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6 LIU C., MA L, LIU Y.L., LUO Z., LEI X., ZHOU X., WANG D., XU H., 2009 - 'Linking tropical cyclone number over the western north Pacific with sea surface temperatures', In: Elsner J.B., Jagger T.H. (eds) *Hurricanes and climate change*. Springer, New York, pp. 205–215.
7 http://www.climatechangenews.com/2013/11/11/its-time-to-stop-this-madness-philippines-plea-at-un-climate-talks/

BIOGRAPHY

Fabio Cian *graduated in Space Engineering in 2009 at Sapienza University of Rome. He worked at the European Space Agency (2009) and at the German Aerospace Center (2009-2012). Since 2013, he is researcher at the Ca' Foscari University of Venice. In 2017, he received a PhD in Science and Management of Climate Change. Using satellite images, he studies disasters in relation to climate change to understand the future risk for people and economic assets.*

He discovered photography in 2008. After a few years, he realised that photography was becoming something more than just a nice hobby. It allowed him to express himself, his feelings, to capture the way he sees the world and to show it to others. This was something he could not do with science and something that he felt and feels the urge to do. Therefore, he decided to commit to photography with greater effort and, in 2016, he followed a course on Documentary Photography at the International Center of Photography in New York.

His scientific knowledge and his ever-growing passion for photography made him decide to use photography not only for his most personal and intimate interests, but also to communicate climate science and climate change. Science can deliver facts and numbers but cannot reach people's emotions. Photography can help make this connection and raise awareness on this important issue.

Fabio Cian looks for harmony when he shoots photos. In the huge mess that makes up this world, he looks for a sort of order, of balance. He likes the idea of fixing things he finds on his path. Taking a photo is like adding some order to the world, to clean it, to tidy it up. This is what connects photography to his scientific background.

FABIO LATTANZI ANTINORI
IN COLLABORATION WITH ECONOMIST GRAZIANO CEDDÌA

The Next Economy

03

HOW DO YOU DISTRIBUTE?

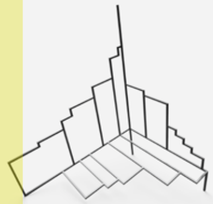
RESONANCES

How far does the invisible hand of the Market reach? Economic thinking has trickled down into all spheres of life, our ideas of right and wrong, our behaviour and even our ideas of love and emotions. What happens if we have profit oriented declarations of eternal love? The Next Economy ironically combines economics and poetry, algorithms and emotions to point to a new and braver world, where the moral limits of the market are clear and we do not apply words as "costs", "benefits", "capital", or "assets" to ethics or behaviour. It would be a fairer world, with more poetry. So the question is: how do you distribute?

FABIO LATTANZI ANTINORI
IN COLLABORATION WITH ECONOMIST GRAZIANO CEDDÌA

03

I feel that this whole process has already gifted me with the coordinates of a new territory whose exploration will influence my artistic practice and many of my future works.



ART
INSTALLATION

The Next Economy is an immersive sculptural work that focuses on the fact that human society, following a gradual yet profound transformation, has finally become driven and controlled by the markets. Within this territory, it seeks to question the condition and identity of men and women as social beings within the community.

The artwork's conceptual approach stems from considering the dangerous consequences of applying the language of the markets and their notion of value, to defining what is right or wrong within the sphere of human behaviour and to the global commons. And while it embodies and renders visible to the audience the process by which the first might ultimately alter and corrupt the last two, it also seeks to identify a system within which the use of words can become a form of critical and global resistance within society.

At the heart of the artwork is a set of algorithms, designed to exchange economic terms with emotional words applied to traditional patterns of poetry writing, based on financial data obtained by a constant reading of international markets. The resulting outcome gives birth to unusual, humorous and dramatic compositions whose similitudes and metaphors range from enigmatic considerations about the meaning of life to profit-oriented declarations of eternal love.

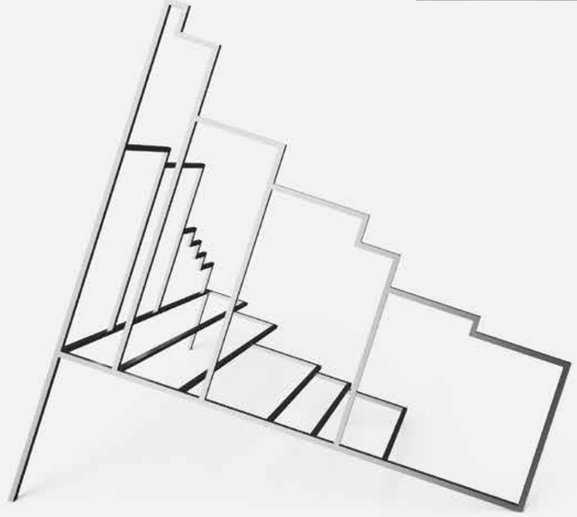
Additionally, by correlating the language of economy with that of emotions, the artwork gives birth to further layers of meaning and interpretations. It alludes to the incremental and ever-growing use of complex non-human AI technologies in trading and management of resources, ranging from real-time stock analysis and trading to forecast of crops and the possible outbreaks of military conflicts, as well as to the role that emotions play within the Stock Market itself, as suggested by theories of behavioural economics and psychology (in particular the HUEMO or Human Emotion theory), whereby traders' decisions on constant risk management under stress are considered to be far from rational and objective, but instead constantly affected by wishful thinking and emotions.

Finally, by applying a playful swapping of words from the language of the markets to the emotional language of poetry, *The Next Economy* attempts to ironically create an opportunity to highlight the narrative of the dominant view of neoliberalism and ultimately inspire the audience and encourage debate in society.

A note on collaboration

In response to the theme of the exhibition, the collaboration with Graziano Ceddìa explored fairness in the context of economy and identified in Graziano's call for a more conscious use of words, a new tool of resistance against the way the language of markets is penetrating and corrupting every aspect of human life. The current narrative of contemporary neoliberalism pervades our society and individual daily life to the point of appearing to be the only option left to us.

I feel that this whole process has already gifted me with the coordinates of a new territory whose exploration will influence my artistic practice and many of my future works.



SCIENCE BEHIND

ECONOMIST GRAZIANO CEDDÌA

According to the prevailing economic paradigm, markets are the most efficient system to allocate and distribute resources. Therefore, the market mechanism should be used as much as possible, even to tackle problems like climate change and migration crisis. There are fewer and fewer realms which are immune to the market logic. Following Michael Sandel[1], it is important to ask the question: are there moral limits to markets? Sandel raises two objections to the ubiquitous expansion of markets:

1) A problem of coercion: in a context characterised by extreme and increasing inequality in income and most importantly wealth[2], how free is the exchange on the free market really? For example, are the very poor really free not to sell their organs? Inequality is extremely damaging in both social and environmental ways[3]. At the same time, inequality undermines the legitimacy of the market system as a distributive mechanism.
2) A problem of corruption: markets are not neutral. The application of the market logic and the market language, when extended to certain realms, taints motivations. Prices as monetary incentives work on what psychologists call extrinsic motivations. In many contexts, they can crowd out intrinsic motivations and thus lead to undesired behavioural changes. In a kindergarten in Israel, for example, monetary fines were introduced to reduce the incidence of parents' delays at picking up their children. As a result, the incidence of delays significantly increased. Before the introduction of the fine, parents felt morally obliged to be punctual, in order not to impose discomfort on the teachers. After the fine introduction, parents felt that as long as they paid the fine they were entitled to be late (i.e., they had purchased the right to be late)[4].

The first objection can be addressed by solving the inequality problem. In a society with more equality, market exchanges are likely to be fairer. The second objection however, is unsolvable and requires a sort of resistance movement. It is necessary to resist the market logic. The resistance must start with words. We must refuse to use certain words, like "cost" and "benefits", "capital", "asset", "liability" in areas like environment and ethics[5]. Words are not neutral, as they bring a whole metaphysical and theoretical structure with them. The words cost, benefits, capital have emerged in the context of mercantilistic exchange[6]. By applying these words, we transfer the whole mercantilistic logic to nature and ethics.

A note on collaboration

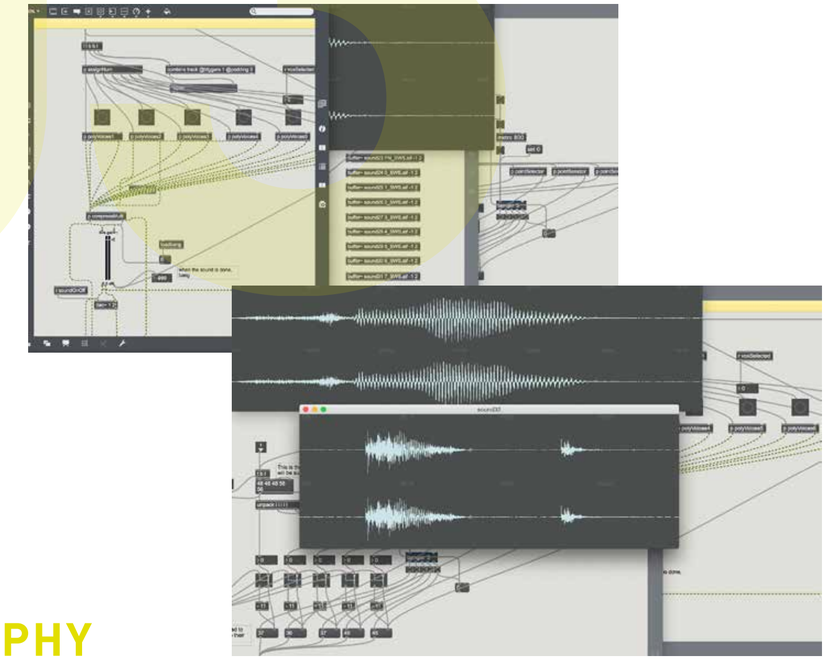
The increasing use of economic jargon in various aspects of life, from environment to morals, reflects a sort of "colonisation" process of economics into other realms. Such a process bears important consequences as words are not neutral, but convey a whole metaphysical structure. Economic terms bring with them an exchange-based utilitarian ideology. Fabio's intuition, to develop an algorithm capable of permuting words expressing emotions, beauty, and moral values with economic terms exposes instantly and in a humorous way the non-neutrality of the market. The ability of art to immediately communicate even complex ideas, represents for me one of its main strengths.

Through the collaboration with Fabio, I have become even more convinced of the need to rely on artistic expression in order to communicate science, reach out to people and promote social change.

> It is important to ask the question: are there moral limits to markets?

1 Sandel, Michael, *What money can't buy: the moral limits of markets*, Farrar, Straus and Giroux, 2013. A shorter essay on the subject is available at http://tannerlectures.utah.edu/_documents/a-to-z/s/sandel00.pdf.
2 See for example the World Wealth and Income Database (http://wid.world/) or the Oxfam report *Unearthed* on the unequal distribution of land in Latin America (available at https://www.oxfam.org/en/research/unearthed-land-power-and-inequality-latin-america).
3 On the pernicious social consequences of inequality, see Wilkinson, Richard, and Pickett, Kate, *The Spirit Level*, Bloomsbury Press, London, 2009. On the negative environmental consequences of inequality, see Dorling, Danny, *The Equality Effect: Improving Life for Everyone*, New Internationalists, 2017.
4 Gneeze and Rustichini (2000), 'A Fine is a Price', *The Journal of Legal Studies* 29(1): 1-18 (available at http://rady.ucsd.edu/faculty/directory/gneezy/pub/docs/fine.pdf).
5 To appreciate the absurdity of the use of economic terms and methods to ethics, it is useful to read Becker, Gary S. (July–August 1973). 'A theory of marriage: part I', *Journal of Political Economy, Chicago Journals*, 81 (4): 813–46 (available at http://www.nber.org/chapters/c2970.pdf). In this essay, the author claims that "marriage…can be successfully analysed within the framework provided by modern economics" (p. 500). He then continues arguing that "Two simple principles form the heart of the analysis. The first is that…the (economic ndr) theory of preferences can be readily applied and persons marrying (or their parents) can be assumed to expect to raise their utility level above where it would be were they to remain single. The second is that, since many men and women compete as they seek mates, a market in marriages can be presumed to exist. Each person tries to find the best mate, subject to the restrictions imposed by market conditions" (p. 500).
6 On the emergence of economic thought in the context of mercantilism and colonialism see Davey, Brian, *Credo: Economics Belief in a World in Crisis*, FEASTA, 2015.

03



BIOGRAPHY

Fabio Lattanzi Antinori*'s work traverses a multitude of media including sculpture, print and interactive installations, examining the language of power and control of corporate systems and its effects on the belief systems of the individual.*
Fabio was born in Rome and earned his MFA in Fine Art and Computational Technologies from Goldsmiths, London, in 2013.
Recent solo exhibitions include THE RYDER, London, (2016), MoCA, Shanghai (2016), Kristin Hjellegjerde, London (2016), Arebyte Gallery, London (2015).
Group exhibitions include the participation in the Odessa Biennale at the Odessa Museum of Modern Art (2017), the Galerie für Gegenwartskunst, *Frieburg (2017), Holon Design Museum (2017), The Flat Gallery (2017), Hangzhou Triennial of Fiber Art at the Zhejiang Museum (2016), Watermans Arts Centre (2015), the Kaunas Biennial at the M. Žilinskas Art Gallery, Lithuania (2015), Pi Artworks, London (2015), New York University (2015), Museum of Contemporary Cuts (2015), Victoria & Albert Museum, London (2014), OCT Contemporary Art Terminal in Shenzen, (2014) and the* Museum für Angewandte Kunst, *Vienna (2013).*
He was awarded the Connections Through Culture bursary from the British Council (2016), the A- N Travel Bursary for extraordinary and inspirational research (2016), the Artist International Development Fund from the Arts Council (2016); he was selected for the Guest Projects (2015), the Florence Trust residency (2014) and the Open Data Institute collection (2012). Public collections include the Word and Image Collection of the V&A, London, the Civic Museum in Villa Lagarina, Rovereto and the Crespina Civic Museum, Pisa as well as various private collections in Trento, Milan, London and Rome. Antinori lives and works in London.

Graziano Ceddia *studied Economics at the University of Siena, Italy. Subsequently, he obtained an MSc and a PhD in Environmental Economics at the University of York (UK). He has been teaching courses on ecological economics at the University of Reading (UK) and at MODUL University Vienna (Austria). His main research interests fall in the area of ecological economics and political ecology, with a focus on land use cover change, deforestation, and land rights in Latin America. He currently works at the Centre for Development and Environment of the University of Bern, where he is leading an ERC funded project looking at deforestation in the Argentinean Dry Chaco and indigenous peoples' land rights. He has been working for the JRC since 2015.*

HONEY & BUNNY
IN COLLABORATION WITH FOOD SPECIALIST ERWAN SAOUTER

Market of Externalities

04

WHAT ARE YOU EATING?

RESONANCES

Would you pay € 35 for a chicken or a loaf of bread? No? Well, that is quite unfair, as so much value has gone into its production! Let's analyse the price we are unwilling to pay: the poisons we spread in the environment for a simple meal, encouraged by the awesome power of the food industry. We pay for herbicides and pesticides, and machinery for harvesting and transport, but we don't pay for their impacts on the health of the planet and its people… Sit down, relax, close your eyes and savour your chips, your noodles, your bread. Is it Glyphosate, Azoxystrobin, Atrazine, Chlorpyrifos or is it gas, gasoline, or coal? What are you eating?

HONEY & BUNNY

IN COLLABORATION WITH FOOD SPECIALIST ERWAN SAOUTER

Table objects
are filled with
strange powders, liquids and
even with dirty water.

ART

INSTALLATION

What a wonderful dining table? Ninety by two hundred centimeters, candles, ten well-designed dining chairs – how nice is that? What a perfect symbol for a civilised community?

But the table is covered with soil and some "strange" powders. It looks a bit devastated. The soil seems broken. The tableware is also a bit different – there are glasses from laboratories, surgical instruments, petri dishes, Erlenmeyer flasks, containers for dangerous goods, etc., instead of Baccarat, Christofle, and Meissen. And these table objects are filled with strange powders, liquids and even with dirty water. Is it maybe Glyphosate, Azoxystrobin, Atrazine, Chlorpyrifos or Metolachlor? Or is it just polluted air or water? Our glasses and containers are simply filled with fungicides, herbicides, insecticides, additives, oil (!) and polluted elements. Our table is covered with the externalities of food production.

But still we do have some food. Visitors see at least some bread, butter, tomatoes, chicken, oranges, beef, potatoes, ready-cooked meat-based meals, cheese, coffee, apples and chocolate. These are the "results" of our externalities. A full meal, we might say. Visitors do also have the chance to download information about our ecological externalities and about the "production needs" of our fantastic edible products: they could download how much water, soil, rainforest, working hours or land grabbing is needed to produce one kilogram of our beef or chocolate. The app looks like a game. It is a game. *It is the economy, stupid*.

But still we do have plates. They are made of white (very white) porcelain. Unfortunately they do have holes. In these holes people find short videos, presented on tablet computers. [Yes, this idea is stolen!] The videos show honey & bunny. They present our ideas of social sustainability, of inequality, of poverty, of fairness. The short films are interpretations of the cultural value: CONSUME.

Fairness is keeping decisions free from any form of discrimination. Does that mean that fairness is an ethical value? And do we need a debate about the environment too? Do we all (7 billion human beings) have an equal right to a fair environment, which keeps us healthy and wealthy? Should we say that sustainability is an issue of fairness?

Notably, the artistic approach to sustainability sets into motion the reexamination of living conditions in the areas of the "Third World", which supply raw foodstuffs to the globalised "world market" for the benefit of the "First World", or of the effects of "climate change" to present and future biological and social systems. So, we are talking about fairness, aren't we? A discussion on sustainability also means investigating the question of why "we", Europeans, consider living sustainably such a challenge. The current way of living, including ethics, such as the belief in a steadily growing market economy, the necessity of constant consumption, or the desire for so-called supermarkets, seems to hinder our reaching a fair way of living.

A note on collaboration

Martin Hablesreiter: This transdisciplinary cooperation bases itself strongly on the idea of using artistic actions as a new method for education for sustainable development in order to academically accompany, and further develop, the transdisciplinary space.

Basically every meeting of artists and scientists implies learning from each other. So it is more than important to meet constantly, but we do interpret these interdisciplinary chats as creating – not as learning. We do need to WORK TOGETHER – not only get inspired by each other. The JRC is in the same way an ivory tower as an artist's atelier or a famous art museum. Ivory towers are comfortable prisons and these institutions do not have the will and power to change something. If we talk about fairness, we also need to go out into the streets to fight for it. We do need to present, to perform, to convince. We need to change. Scientists of the JRC are willing to change. That´s what we have learned at Ispra. But we need to help each other – to cooperate to find ideas of change. Learning is not enough!

The Global Report:
"Agriculture at a Crossroads"
by the United Nations says that we definitely
need to change the world's food production to
stop climate change AND to
create a fairer society.

SCIENCE BEHIND

MARTIN HABLESREITER AND MICHELA SECCHI

Externalities are somehow the opposite of fairness. For economics, an externality is the cost that affects people who did not choose to incur that cost. If Europeans take water or land from Third-World countries to produce food for their own market, they produce externalities for the inhabitants of these regions. If Europeans change the climate because of their tendency to overconsume, they change the living conditions in several regions. Europeans produce lots of externalities and food production is the worst player. The global report *Agriculture at a Crossroads* by the United Nations says that we definitely need to change the world's food production to stop climate change AND to create a fairer society.

Neoclassical welfare economics asserts that, under plausible conditions, the existence of externalities will result in outcomes that are not socially optimal. Those who suffer from external costs do so involuntarily, whereas those who enjoy external benefits do so at no cost. The person who is affected by the negative externalities in case of air pollution will see it as lowered utility: either subjective displeasure or potentially explicit costs, such as higher medical expenses. The externality may even be seen as a trespass on their lungs, violating their property rights. Thus, an external cost may pose an ethical or political problem.

Food production causes air pollution, soil erosion, land AND water grabbing, etc. Food production needs lots of (fossil) energy, it may destroy biodiversity and it could harm people's health. Fertilisers, pesticides, fungicides, industrial farming provokes environmental costs. Who is taking care of these costs? The public? Martin & Sonja asked us to deal with externalities of BREAD and WINE. They forced us to find data about the externalities of one kilogram of bread and one litre of wine. We got these questions:

- How much soil (sqm) is needed to produce one kilogram of bread and one litre of wine?
- How much water is needed to produce one kilogram of bread and one litre of wine?
- How much oil (energy) is needed to produce one kilogram of bread and one litre of wine?
- How much soil do we destroy with the production of bread and wine?
- How much water do we contaminate within this production?
- Which "chemicals" (fertilisers, fungicides, pesticides, cleaners, additives) are needed to produce one kilogram of bread and one litre of wine? We need the exact of amount of the average production to use it directly at the installation.
- How much CO2 do we pump out to the atmosphere during the production of bread and wine (from field to household)?
- Where do we produce bread and wine – where is the land?

We provided Martin & Sonja with a number of data concerning the inputs needed to produce one kilogram of bread and one kilogram of red wine. These data are retrieved from a model specifically designed to represent the entire life-cycle of an average type of bread and an average type of wine. It takes into account all the material inputs occurring at each step, including the raw materials and also energy, water, chemicals, etc. It also takes into account all emissions resulting from the production, use and disposal of these two products. The figures we shared focused on the land (in terms of occupied area), on energy (from both fossil and renewables sources) and on the water volume needed in the production phase, use phase and end-of-life phase. Additionally, the use of chemicals such as fertilisers applied during the agricultural phase, are included as well, e.g. in terms of emissions to air, soil and water. Ultimately, when talking about food it is not sufficient to consider only the life cycle, but other impacts must be considered too: the impacts on our climate, toxicity and use of resources. Only then we have an overall picture of the environmental aspects linked to the products we produce and consume.

04 BIOGRAPHY

Sonja Stummerer and Martin Hablesreiter *both studied architecture in Vienna, London, and Barcelona. After graduation, they worked for a year as architects in Tokyo, Japan, before founding the interdisciplinary architecture studio* honey & bunny *in Vienna in 2003. They have realised several building projects in Vienna, directed a movie "food design – der Film", curated the exhibitions "food design" at the MuseumsQuartier Wien, "food design humanity" at Lodz (Poland), and participated as designers and eat artists in numerous international solo and group exhibitions, among others in London, Zürich, Vienna, Salzburg, Milan, Amsterdam, Gwangju, and Hanover. Since 2011, they perform on sustainability, cleaning, and eating, in places like Milan, Paris and Salzburg.*
In 2005, they published the book "food design – von der Funktion zum Genuss" (Springer Vienna/NY), in 2009 "food design XL" (Springer Vienna/NY) and in 2013 "eat design" (Metro Verlag Vienna). Stummerer and Hablesreiter have given many international talks, were visiting lecturers in Bucharest (RO), Istanbul (TR), and Chennai (IN), and currently teach at the New Design University St. Pölten, the University of Salzburg and the Austrian Marketing University of Applied Sciences.

Michela Secchi*'s background is in Environmental science. During her Master's Degree at the University of Milano-Bicocca, she oriented her studies to the sustainable development of the production systems and the tools to evaluate it. Life Cycle Assessment (LCA) is her main field of expertise, especially focused on the assessment of bio-based materials. At the Joint Research Centre, she is currently working as data analyst in the Bioeconomy Unit, supporting the LCA team in data mining and in using specific software.*
The work on the SciArt project has been done in collaboration with Valentina Castellani, Francesca Reale and Erwan Saouter.

DAVY VANHAM & LUC FEYEN
RESEARCHERS ON CLIMATE CHANGE AND ENVIRONMENTAL SCIENCES
MOVE INTO PHOTOGRAPHY

The Water we Eat

05

HOW MUCH WATER DO YOU EAT?

RESONANCES

Welcome to our world: about a billion hungry and a billion overweight. And not enough water to go around! Your steak has consumed more than 5.000 litres of water before it got to your plate. Your Big Mac, that simple pleasure you enjoyed as a child, suddenly feels awkward. A beer is not just a beer, a steak is not just a steak. That plate of pasta, that business lunch, day after day… How much water do you eat?

DAVY VANHAM & LUC FEYEN

RESEARCHERS ON CLIMATE CHANGE AND ENVIRONMENTAL SCIENCES MOVE INTO PHOTOGRAPHY

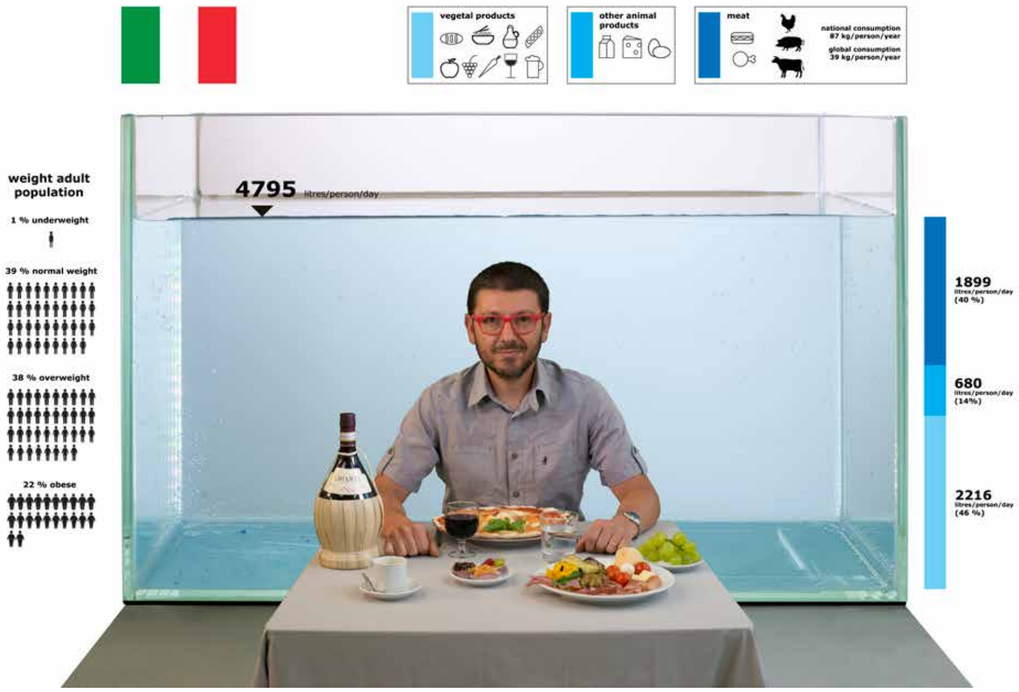
ART

INSTALLATION

05

One of the key challenges of our time is to achieve global water, food, and energy security in a sustainable way. Davy Vanham and Luc Feyen, who are both scientists and photographers, make a photographic excursion to evaluate global food consumption behaviour and the water resources required to produce this food, for a selection of nations around the world. This excursion is made in a studio setting, displaying an individual from a selected country with his/her average typical diet and the amount of water required to produce it in the background. By using real-life dimensions for the water volume, the observer gets a tangible feeling of the water quantities we are talking about. These range from 2.000 litres per person per day (equaling 2 cubic metres per person per day) to 6.000 litres per person per day (equaling 6 cubic metres per person per day). These are enormous amounts compared to the water we directly use in our daily life, like water for drinking (1 to 2 litres per person per day) or water for taking a shower (about 50 litres per person per day in industrialised countries). In their installation, essential fairness questions regarding the global food system and its relation to water resources are visualised.

By using real-life dimensions for the water volume, the observer gets a tangible feeling of the water quantities.



DAVY VANHAM & LUC FEYEN

RESEARCHERS ON CLIMATE CHANGE AND ENVIRONMENTAL SCIENCES MOVE INTO PHOTOGRAPHY

SCIENCE

BEHIND

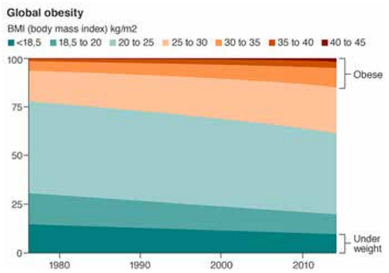
FOOD SPECIALIST DAVY VANHAM

Providing global food, water, and energy security to a rapidly increasing and urbanising world population in a sustainable way (i.e. within planetary boundaries), is one of the largest challenges for humanity.

The shift to healthy diets is key to this challenge. Currently, malnutrition and overconsumption happen side by side, between but also within countries. Resulting underweight, overweight, and obesity also happen side by side (Figure 1), leading to substantial decreases in life expectancies and extreme high costs for health care systems around the globe. Even in developing countries, overweight and obesity have risen fast.

According to the World Health Organisation (WHO), many low- and middle-income countries are now facing a "double burden" of disease:

- While they continue to deal with the problems of infectious disease and undernutrition, they are experiencing a rapid upsurge in noncommunicable disease risk factors such as obesity and overweight, particularly in urban settings.
- It is not uncommon to find undernutrition and obesity existing side-by-side within the same country, the same community and even the same household.



Since recently, there are more obese than underweight people in the world. Body Mass Index (BMI) <18.5 underweight; BMI from 18.5 to 25 normal weight; BMI from 25 to 30 overweight; BMI≥30 obese. Source: The Lancet (2016).

Research has shown that in developed countries the average intake of the following product groups should:

- decrease: meat, sugar, fats and oils
- increase: fruit and vegetables.

Food from product groups that should be decreased in consumption are generally very resource-intensive to produce, whereas vegetables and fruit are much less so. One of the key resources for food production is water. Water is a globally finite resource, just like land or specific nutrients. The water footprint concept was developed to quantify the water resources

> Water is a globally finite resource, just like land or specific nutrients.

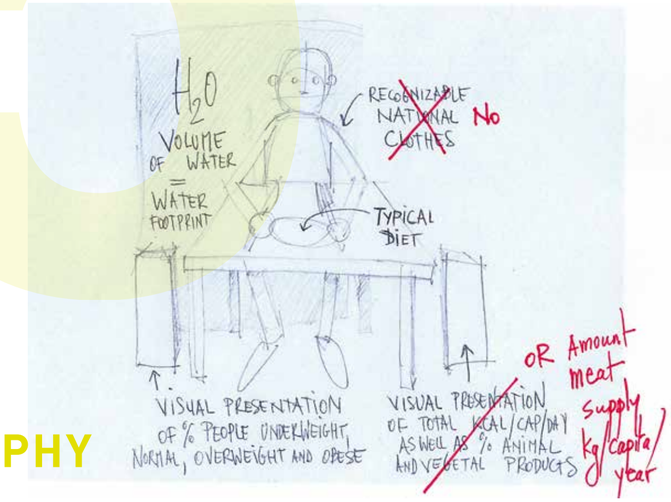
that are required to provide a product taking the whole supply chain into account. Average global values can be found on the website of the Water Footprint Network (http://waterfootprint.org). As an example, the average global water footprint (green plus blue water) of one kilogram tomatoes is 171 litres, of sugar 745 litres and of pork meat 5,389 litres. A study on the water footprint of EU consumers showed that the water footprint for the current diet would decrease from 3,873 litres per capita per day (l/cap/d) to 2,979 l/cap/d for a healthy diet containing meat and to 2,394 l/cap/d for a healthy vegetarian diet.

We address the issue of fairness by visualising average national diets of a selection of countries, showing values on meat consumption, percentages of populations underweight to obese and the associated water footprint of these average diets.

This visualisation addresses key fairness questions such as:

- Who eats what and how much?
- Is food supplied to global population in a fair way (as compared between countries, but also within the population of a country)?
- Are (water) resources used in a fair way? Do certain nations/population groups require more globally limited available water resources for their own food consumption than others?
- Can we save water resources through our diets?

05



BIOGRAPHY

Davy Vanham, *born 1974 in Belgium, is a water accounting and water management specialist. Since 2011, he has been working as a scientific project officer in the Water and Marine Resources Unit at the Joint Research Centre of the European Commission, Ispra, Italy, in the area of water and water resources. He holds a Master's degree in environmental engineering (University of Leuven, Belgium), a Master's degree in water resources engineering (University of Brussels, Belgium) and a PhD in water resources management (University of Innsbruck, Austria). He has more than 15 years of working experience in water management both in the private sector (for engineering consultants) and the public sector (universities and the European Commission), of which many years abroad. This includes several years of professional experience in developing/transition countries (South Africa, India, and Ecuador). Photography is his second big passion. He has worked as a professional photojournalist, published a photo-book on transhumance in the Tyrolean Alps and experimented with kite aerial photography (KAP).*

Luc Feyen *is an expert in the field of climate change impacts and adaptation. He works as a research administrator at the Joint Research Centre of the European Commission, Ispra, Italy, on Disaster Risk Management. He holds a degree in environmental engineering (University of Leuven, Belgium) and a PhD in hydrology (University of Brussels, Belgium). After a postdoc at Stanford University (USA), he joined the JRC in 2005. He is passionate about photography, with a particular interest in nature, people, and nature-human interaction. His work has been exhibited at the Academy of Fine Arts in Leuven, Belgium (2013). He won the 2017 JRC photo competition on "the beauty of the bicycle".*

ANAÏS TONDEUR
IN COLLABORATION WITH ATMOSPHERIC SCIENTISTS RITA VAN DINGENEN
AND JEAN-PHILIPE PUTAUD

A Particular Matter

06

DO YOU THINK BORDERS WILL PROTECT YOU?

RESONANCES

Jump in your car, drive to work. Use the atmosphere as a waste bin for fumes. Then watch them travel freely on the winds only to land deep into a lung on an innocent in-breath, in the back garden of someone you may never meet, or on the ice of pole and mountain. Beautifully polluted cloudscapes, uncaring for borders or walls. Do you think borders will protect you?

ANAÏS TONDEUR

IN COLLABORATION WITH ATMOSPHERIC SCIENTISTS RITA VAN DINGENEN AND JEAN-PHILIPE PUTAUD

ART

INSTALLATION

Yesterday, they discovered a black dot in a fold of my heart.
How did it reach the inside of my body?
I have been told it is a grain of black carbon.
Ella, Fair Isle, 2017

From the upper stratosphere to cells inside our bodies, natural and polluted particles travel over the globe. This project takes the form of an installation of interwoven narratives and journeys on the trail of a meteor. Engaging the visitors into the manifold interactions of atmospheric flows and anthropic emissions, this installation opens a common ground to reflect upon our mode of existence, our sense of common good and fairness today.

Our story began on the northernmost island of Scotland, on the remote reef of Fair Isle. Despite the absence of industries, despite the small number of vehicles and heated households, as the wind blows southwest, the sixty islanders suffer from suffocation. That is how, in early spring, doctors came to discover a grain of black carbon in a fold of the heart of the birdwatcher's daughter.

Through the embodied perspective of this character we invented, we unravelled the journey of the anthropic meteor, which erupted into her body. We travelled back to the point it was emitted from the exhaust pipe of a ship in the English Channel, at the southern edge of the North Downs. We could retrace the precise itinerary of this particle by means of atmospheric backward trajectory models and of the analyses of anthropogenic emission of air pollutants that the European Commission makes each day. Yet, this abstract trajectory line leads us to a journey of 837 miles (1347.02 km) by foot, ferry, fishing boat, bus and car. We dwelled through the desolate moorland of Fair Isle, on the edge of its vertiginous cliffs, home of puffins, Siberian passerines, guillemots, fulmars, escaping by a hair's breadth the attacks of great skuas. We sailed through the tormented meeting line of the Atlantic Ocean and the North Sea, walked through the coal field of Northumberland, over mountains and hills, pastures and fields, crossed the border of Scotland and England. We traversed the historical town of Edinburgh, the suburban areas of Nottingham, Leeds, Sutton-in-Ashfield, London and Borough market, a few days after the June tragedy, to eventually reach the harbour of Folkestone.

Our equipment on the expedition was composed of helmets crowned with a little camera, through which we crystallised each day's journey in a photograph taking a unique point of view: that of the skyline. Our walking outfit was also supplemented with breathing masks and filters through which we trapped the black carbon particles we encountered. These particles were later extracted by JRC scientist Jean-Philippe Putaud and turned into ink. In point of fact, black carbon is a collateral form of soot, used for centuries as the primary component of Indian ink. The photographs visible in the installation are thus composed of a percentage of ink made from the particles filtered on the corresponding part of the walk.

This project was realised with the atmospheric scientists Rita Van Dingenen, Jean-Philippe Putaud and their colleagues, sharing expertise and imaginaries through which we constructed the possibility of these narratives and planned the expedition. Our endeavour with this project was to elucidate the dangers we create, addressing the consequences for the environment and human health of what is essentially a choice of society.

This particulate matter of less than 2.5 micrometer (in aerodynamic diameter) knows no limit between inside and outside. Associating everyone and everything in an unbound meddling[1], they enter our bodies, penetrate the membrane of our lungs, reach the deeper folds of our brains, flow with our blood cells and trigger deaths. According to World Health Organisation, 3.5 million of persons die each year just from breathing the outside air, not taking into account the diseases these particulate pollutants provoke[2]. Is it because of their invisible, intangible, and even inodorous presence that we are not prompted to react? In contrast to carbon dioxide, the lifetime of which spans several decades, black carbon remains in the atmosphere only a few weeks. Reducing its emission would drastically diminish this sanitary tragedy and immediately slow down the warming rate of the planet, and to a large extent, the rapid change of the Arctic.

1 Michael Marder, *Dust*, Bloomsbury Edition, 2016.
2 *WHO considers 7 millions premature deaths are caused by air pollutions, positioning the latter as one of the most significant environmental risk for health worldwide).*

06

We invented,
we unravelled
the journey of the
anthropic meteor.

ANAÏS TONDEUR

IN COLLABORATION WITH ATMOSPHERIC SCIENTISTS RITA VAN DINGENEN AND JEAN-PHILIPE PUTAUD

SCIENCE BEHIND

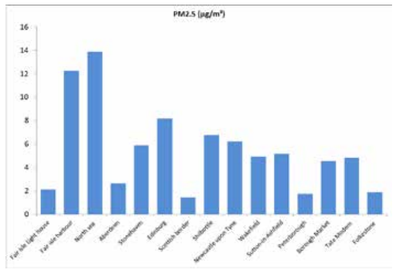
ATMOSPHERIC SCIENTISTS R. VAN DINGENEN & J.-PH. PUTAUD

The atmosphere is a dynamic system that is essential to life on Earth. It receives inputs from natural and man-made processes, it provides outputs to the oceans and the biosphere, it flows, mixes and moves around. Watched from space, it appears as an amazingly thin and vulnerable blanket. It is our habitat that protects us from harmful radiation and provides the air we breathe.

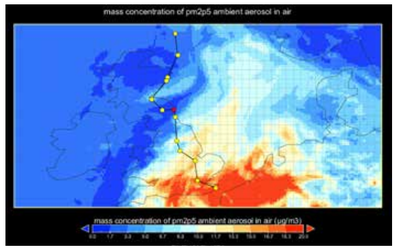
Wind and air pollution are not stopped by country borders. Whatever is released into the air from a local source is carried around for hundreds, sometimes thousands of kilometres. Industrial processes, road transport, wood burning, and energy production are some of many human activities based on fuel combustion that emit pollutants into the atmosphere. They become part of the air we breathe and impact our health. The major health-impacting airborne substance is fine particulate matter, tiny particles about 50 times smaller than the width of a human hair that remain suspended in the air for days to weeks. They are produced in the combustion process as complex carbonaceous mixtures, partly in the form of microscopic soot. While suspended in the air, more polluting secondary components will stick to them, for instance sulphate and nitrate, resulting from the photochemical reaction of nitrogen oxides emitted from diesel cars, and ammonium released from agricultural practices. Ambient air pollution is estimated to lessen life quality and expectancy, contributing as a risk factor to cardiovascular disease, stroke, lung cancer and chronic pulmonary disease. Therefore, a strong fairness element is at play: who is benefiting from the processes causing the pollution, who is suffering from the impacts?

Because of its trans-boundary character, air pollution is regulated by international conventions. European legislation has put a limit on the annual average concentration of fine particulate matter (PM2.5) of 25μg/m^3. The World Health Organisation however recommends a maximum exposure limit of only 10μg/m^3 as an acceptable level although there is no evidence that a level below PM2.5 has an impact on health.

The transport and fate of atmospheric pollutants is studied by observing their concentrations levels in the air in monitoring stations, by using remote observations from satellite sensors, and by using mathematical models simulating all relevant atmospheric, physical and chemical processes. Although mathematical models are an approximation of reality, they can help to answer the "fairness" question above, for instance by simulating the trajectory followed by air pollutants from their release point or, inversely, calculating backwards the trajectory followed by an air parcel that arrives at a given endpoint.



Modelled PM2.5 concentration during the artist's journey (source: COPERNICUS CAMS reanalysis between 23-05-2017 and 11-06-2017, https://atmosphere.copernicus.eu/about-cams)



Modelled PM2.5 concentration during one of the days of the artist's journey (source: COPERNICUS CAMS reanalysis, https://atmosphere.copernicus.eu/about-cams).

A note on collaboration

We immediately made a click – when, during the Artist and Scientist workshop, I briefly presented the modelling work and research I am doing, and how the trans-boundary character of air pollution relates to fairness, and when I showed artists how we measure air pollution at the site. Anaïs brought the fairness aspect from the abstract world of computer models gridmaps output to the essence: pollution does impact on individual lives, on people. You can't control what you breathe in the same way you control what you eat. On food labels, you can read the place of origin, for the pollution you breathe you can't. This put my research in a human-size perspective and for sure provides inspiration for the way I present my work to the public.

Anaïs' project sparked some new ideas for my own research – I started using datasets and model output that is publically available from European scientific projects.

In this project, we use the outcome of mathematical models of the atmosphere to estimate the PM2.5 concentration at the locations passed during the journey of the artist, and to trace back the origin of the air particles she was breathing.

… fine particulate matter, tiny particles about 50 times smaller than the width of a human hair …

BIOGRAPHY

Anaïs Tondeur *is a visual artist. She works and lives in Paris. Her artistic practice takes form at the point where disciplines meet. Crossing natural sciences and anthropology, myth making and new media processes, she creates speculative narratives and investigations through which she experiments with other conditions of being-to-the-world. For this, she searches for a new aesthetic, in the sense of a renewal of our modes of perception, and explores, beyond the separation of nature and culture, ways to disrupt the grand narrative of the Anthropocene.*

Her current interest in issues of deep time and the singularity of vegetal life has led her to work with geological processes, radiogenic phenomena and their socio-political implications.

Her protocols of research took her in expeditions at the frontiers between tectonic plates, across the Atlantic Ocean, in the Chernobyl Exclusion Zone or through sterilised soils of urban environments. Moreover, when she is not able to access her fields of investigation, she creates vehicles of fiction, travelling for her. She thus recently sent a dream to space, on board of the NASA OSIRIS REx spacecraft.

Anaïs Tondeur has collaborated with philosophers, anthropologists, geologists, oceanographers and physicists. She was artist in residence at CNES (National Space Studies Center, 2016), National Natural History Museum, Pierre and Marie Curie Institute during the COP 21 (2015, Paris), Hydrodynamics Laboratory, (CNRS, École Polytechnique, 2013-2015). She graduated from the Royal College of Art (London, 2010) after completing a Bachelor (Hons) at Central Saint Martin (London, 2008). Recipient of Ars Electronica Honorary Mention (2015), she has presented her work in institutions such as Centre Pompidou (Paris), Gaité Lyrique (Paris), GV Art (London), Bozar (Brussels) and Houston Center of Photography (USA).

Rita Van Dingenen *is a senior scientist working at the JRC Institute for Environment and Sustainability in the field of air quality and climate since 1990. She has been active in laboratory studies, field campaigns, and modelling studies on health and climate aspects of atmospheric aerosols and particulate matter. For the past 10 years, her field of interest focused on the development and application of integrated impact assessment tools for the evaluation of air pollutant emission scenarios in a global framework. She has contributed to several studies and high-level publications on air quality co-benefits of climate policies, and climate co-benefits of air quality policies. As such, she is enthusiastically contributing to JRC's mission to provide EU policies with independent, evidence-based scientific and technical support.*

Rita Van Dingenen was awarded a PhD from the Ghent University in Belgium in Physics in 1989. She has co-authored over 70 peer-reviewed papers in scientific journals.

Jean-Philipe Putaud *is a senior scientist at the JRC Institute for Environment and Sustainability in the field of air pollution and climate change. He is responsible for the development of monitoring equipment and strategies that allow for the monitoring of the implementation of EU and UN regulations to protect air quality, as well as for unveiling the interactions between air pollution and climate change. He was awarded a PhD from the University of Paris. He has co-authored over 60 papers in scientific journals.*

LORENZO MONTANINI
IN COLLABORATION WITH MIGRATION SPECIALIST DANIELA GHIO

The Grand Scientific and Social Exhibition

07

WHERE SHALL WE MEET?

RESONANCES

Inheritors of former migrations, we continue to wrestle with our hidden remnants of tribe, religion, and history, decrypting and encrypting the echoes of the past. Time doesn't stop though, and East and West, North and South keep blending. The dispossessed and the hungry keep coming, pushed by unfair poverty, pulled by our unfair opulence. They invoke another coming together, in your family, street, village, country, in your Europe. So the question is: Where shall we meet?

LORENZO MONTANINI

IN COLLABORATION WITH MIGRATION SPECIALIST DANIELA GHIO

ART

INSTALLATION

Which history
of Europe
do we want
to tell today?

07

Nobody is exonerated from his private Middle Ages

The Greatest Show on Earth - The Grand Scientific and Social Exhibition is an installation inspired by the "Grand Traveling Museum, Menagerie, Caravan & Hippodrome" of P.T. Barnum, who used to say "we've got something for everyone". Part of Barnum's caravan was a "human zoo", which showed, locked behind bars, human beings considered dangerous or exceptional.

The so-called "Barnum effect" (or "Forer effect") is the phenomenon whereby individuals, confronted with a general psychological profile that supposedly refers to them, tend to recognise themselves in it and consider it precise and accurate, without realising that the profile is vague and generic, written specifically to appeal to a wide range of people.

Which history of Europe do we want to tell today?

This work is an investigation of our fears and of the historical moment that Europe is going through, characterised by great uncertainties and great waves of migrants.

Using a metaphor – the construction of a traveling circus – the installation tries to draw a portrait of our society, underlining its inconsistencies and confronting the spectator with his/her own fears and doubts.

The work is divided in three parts[1]:

The Wagon Cage is an installation of a cart with bars, based on models used at the end of the 1800s or beginning of the 1900s. Instead of wild animals, the wagon contains a group of migrants. On a closer look, the visitor discovers that the tableau of migrants kept behind bars is a portrait of Europe: each of the founding countries is represented by a person of the non-European nationality most present in the founding country. An old lady sits next to the wagon, her name is Europa, her age is the average age Europe would have if it closed all incoming and outgoing migratory flows.

The Burqarium is a cart with two glass display cases confronting each other. In the first display case, a woman in full-body garment. In the display case in front of her, a woman that seems naked. A slow and circular movement, constantly repeated, will flip their roles: she who was wearing the full-body garment will remain without clothing, she who was naked will put on the full-body garment.

The Incredible Human Cannonball consists of a cannon like the ones used to shoot out humans. At fixed hours of the day, the human cannonball will arrive and, after a short speech, will be shot to the stars. When the fireworks and smoke lift, a television set installed in front of the cannon will announce a suicide attack, showing archive images of the attacks in Europe over the last few years.

The installation addresses various themes, all linked to the vision we have of society and ourselves. Where are we going? What are we becoming? What do we fear? How can we imagine a more equal world?

In a famous anecdote of the French Revolution, a group of Carmelite nuns chose the guillotine rather than to eliminate their veils as the revolutionary tribunal demanded. In a world where male domination was the rule, the convents also represented a harbour for female freedom.

A fundamental part of embracing a religion is the free assumption of commitments devoid of necessity. It becomes impossible to judge from the outside what blend of freedom and conformism have contributed to such a choice. Only in the private sphere could one formulate an opinion – and even that might be impossible. So how can we judge?

Art can be an efficient instrument to approach the debate on these themes, while science can provide the information and instruments necessary for a better understanding of our society; keeping in mind that the goal is not so much finding answers but rather a deeper comprehension of the questions posed by our present, to recognise that the world is not made of simple dichotomies, of black and white, of a Manicheism that, historically, we should have left behind, but that re-emerges with each historical and social crisis.

1 Not all parts might be realised for the JRC Resonances II Exhibition in the National Museum for Science and Technology Leonardo da Vinci in September 2017.

SCIENCE BEHIND

MIGRATION SPECIALIST DANIELA GHIO

In the field of migration research, several theoretical models may be developed on the basis of specific observations, each formulating a different hypothesis on migration drivers. Nevertheless, disciplinary assessments evaluate migration research as lacking theoretical propositions: empirical studies should be considered as complementary. It implies that one of the dominant theories on the causes of migration remains the neoclassic one, with its assumption that migration is primarily stimulated by economic decisions of relative benefits and costs, both financial and psychological (Todaro, 2006).

1. *The Wagon Cage* tackles the perception of an invasion of migrants. According to Eurostat, on 1 January 2016, out of the ca. 500 million total population residing in Europe EU-28, only 35.1 million people were born outside the EU-28. In relative terms, the share of non-nationals accounted for 7% of the total population of the EU-28; in Germany, this proportion climbs to about 10%. The Wagon Cage presents this fear of invasion showing the limits of this perception. The differences reveal themselves to be superficial, limited to external aspects: what is foreign suddenly talks the crass dialect of Rome, Paris, Brussels… The migrants are unveiled as autochthones, born in the host countries. The tower of Babel shows itself as pointing to a well-integrated system that helps the migrants acquire the language of the host country. Language is considered as one of the main indicators ("proxy") to simulate the immigrants' cultural integration process into the host societies. This suggests a methodological rethink of the meaning of national citizenship.
2. *The Burqarium* focuses on the approach towards the status of women in our societies: is this status the best index to gauge the degree of civilisation attained by a particular society? If so, the European Institute for Gender Equality recorded that in 2015 in Europe EU-28, one in three women (or 61 out of 185 million) has experienced physical or sexual violence, or both, from the age of 15 years. Not all EU-28 Member States have specific laws on violence against women. The 2011 Council of Europe Convention on preventing and combatting violence against women and domestic violence (the so-called Istanbul Convention), which is considered the most important legal instrument on violence against women in the EU, was signed by all EU-28 MS but ratified by only 14 MSs to date.
3. *The Incredible Human Cannonball* combines the recent terrorist attacks with the uncertainties of the migrant. It stands, on the one hand, for the violence as demonstrated by the increasing number of deaths and wounded, and on the other, for migration as a leap into an unknown future – a shot in the dark. Who are the attackers? While fear of infiltration and manipulation by terrorists might seem justified, many attacks in Europe were mostly perpetrated by second- or third-generation migrants: youths who seemed perfectly integrated, but became radicalised in relatively short times.

A note on collaboration

On a more personal note, I must confess I felt very sad on reading Lorenzo's proposal: remembering that "No one leaves home unless home is the mouth of a shark" (Warsan Shire, 2013, *Teaching my mother how to give birth*). It was indeed difficult to accept that migration could be presented by means of a wagon cage.

However, when we met and had the chance to discuss face to face, I changed my mind. I did not want to explain a work of art, and Lorenzo did not want to be explained; I left Italy ten years ago; he is still a migrant.

We started sharing our language and inverting our roles. I could say that wearing artist's clothes stimulates my scientific ability, as I am obliged to adopt a different perspective, I have to communicate scientific methods clearly, I must show the validity of achieved outcomes and am forced to admit the limit of science in formulating a unique theory to explain migration.

Then, we worked on the reassessment of the classic approach based on the judicious use of current scientific evidences. As a result, we re-conceptualised the migration paradigm consisting of the two opposite forces that impose migrants to live a dialectic experience: the belonging to the original identity and the strength of becoming "like your neighbours".

This paradigm traces the general framework of migrants' conditions, which statistics analyse using datasets and models, whereas it can be expressed by emotions through works of art. *The Grand Scientific and Social Exhibition* is an allegoric picture of the most common fears about migrants and general incapacity to tolerate differences.

Can the relation between sciences and arts be defined as a sort of mutual compensation or a perpetual dilemma? Similarly to migration, it oscillates in a precarious equilibrium or, in Italian, *in bilico*, hanging in the balance: "… tiraillée entre l'impossibilité de rester tel qu'on était et la difficulté de devenir autre." (Micone, 1992 - *Le Figuier enchanté*).

07

No one leaves home unless
home is the mouth of a shark.
(Warsan Shire)

BIOGRAPHY

Lorenzo Montanini *(b. 1980) is an Italian director and actor. He studied with many artists in Italy and abroad, amongst whom: M. Tarasco, B. Meyers, The Living Theatre, Milon Mela, E. Vargas, Teatro de Los Sentidos, A. Bogart and the SITI Company. He has lived in the United States where he studied cinema at the New York Film Academy and was the first Italian to have been selected by the SITI Company to study with them at the Columbia University and the Skidmore College.*

He practices and teaches the Viewpoints training and the Suzuki Method of Actor Training and has been, for over 13 years, directing a contemporary theatre lab at the Oriental University of Naples, creating each year a text that has never been translated or produced in Italy. Since this year, he also collaborates with the University Romatre.

His plays have been performed at various festivals in Europe and America, including the Festival Iberoamericano de teatro de Bogotá, XXXVI Festival Internacional de teatro de Manizales, X Fiesta de las Artes Escenicas de Medellin, Festival Iberoamericano de Cadiz, Napoli Teatro Festival Italia, *Longlake Festival Lugano,* Festival Internazionale di Montalcino, *Roma Fringe* Festival, Festival Tramedautore OUTIS Milano. *He has worked with theathres as the* Teatro Mayor Julio Mario Santo Domingo *(Bogotá),* Casa Ensamble *(Bogotá), La Mama ETC (New York),* Piccolo Teatro Grassi *(Milano),* Teatro Stabile d'Innovazione Galleria Toledo *(Napoli),* Teatro Furio Camillo *(Roma),* Teatro Studio Uno *(Roma),* SalaUno Teatro *(Roma). As an actor and performer, he has worked with, amongst others, the Palissimo Dance Theatre Company and the* Teatro de los Sentidos.

He has also worked as director and actor with the United Nations, participating in projects aimed at creating a dialogue between arts, science and politics.

Daniela Ghio *is a demographer specialised in migration studies. She earned her Ph.D. from the University of Montréal (Canada) with a thesis on integration and return behaviours of migrant populations, adopting a multiregional approach.*

Daniela has been an advisor on migration policies for the Italian Ministry of Interior, particularly supporting the evaluation plan of the European Asylum Migration Integration Fund (AMIF) National Program, as member of the Task force for AMIF and Internal Security Funds' evaluation, established by the European Commission General Directorate Migration and Home Affairs. From 2011 to 2015, she worked with the European Asylum Support Office (EASO) located in Malta, contributing to its start-up and developing a first strategy for the early warning and preparedness system measuring the European Member States' capacities to face the migration crisis and put in place appropriate responses. Collaborating and leading teams composed of national experts, she was involved in operational support activities in Greece, Italy, Bulgaria and Cyprus to redesign national migration systems. The objective was making these systems more efficient and effective in assessing policy needs and accomplishing priorities.

She is a lecturer in the European Master in Official Statistics (EMOS) programme at the University of Pisa, Italy.

Currently Daniela is a scientific expert in Demography and Migration working in the JRC's Center for Advanced Studies on a joint project between the JRC and the International Institute for Applied Systems Analysis (IIASA), with the objective of feeding into the multi-dimensional modelling of future European and African population trends.

MARKUS ZOHNER
IN COLLABORATION WITH PHILOSOPHER NICOLE DEWANDRE AND
MEDIA SPECIALIST PAULO ROSA

Radio Franken-stein

P1

WHAT DO YOU REPAIR?

RESONANCES

The cells of the bodies renew themselves continuously and yet, we always feel we are the same person. We feel the same person and yet, we get ill and our bodies fall apart. We are soon going to be able to repair our bodies like we now repair cars. Are we still going to be human if we print for ourselves a new liver, heart, or lung? Will we still be the same person if we plug in some more terabytes into our brain? What will happen to our Self if we transplant our old head on a young body? What do you repair?

MARKUS ZOHNER
IN COLLABORATION WITH PHILOSOPHER NICOLE DEWANDRE AND
MEDIA SPECIALIST PAULO ROSA

What makes you be yourself?
What makes me be myself?

ART INSTALLATION

Women and men above you, around you, you see only their eyes, their faces being hidden behind green masks. They will cut you. They will hurt you. Your blood will be stopped. You will not feel anything. You will live. You will wake up as someone else.

What makes you be yourself? What makes me be myself? Are you a human because you have a heart? Because you have eyes, a brain? Because you walk upright, because you mate with pleasure? Because you can read, write your name, remember, because you think you know you exist?

Are you this man because you have this knee, this pain in the shoulder, this heart, this love for this vanilla pudding, this faith in this God, this memory of this grandmother?

Why do you love being stroked at your breast, and what would you be without this desire?

Does it matter where your hand comes from? Your kidney? Your stomach? Your words? Your singing?

They will anaesthetise you. They will dismember you. They will throw away the superfluous, replace the bad pieces, exchange old for new. They will cut, they will understand each other with short commands, they will make split-second decisions. Super-sharp scalpels will sever muscles, tendons, blood vessels, nerve fibres, neurons.

Blood will be stopped, cleaned, exchanged. You will get new organs from Dr. Frankenstein, custom-made. Joints, designed, created, oiled for an eternity. What do we do with those eyes, those lips, those rounded shoulders? Take out this smoky lung, print out a new one and put it in! Out with the much too weak heart, give me current, so that the new one starts up! Should we keep the head, is this brain worth it?

You will wake up as a new human being. Resurrect from the decay of life, rejuvenated, beautified, much better, much newer, much more yes-you-can'ed.

Your new penis, made from the cultured cells of your umbilical cord, again and ever ready, firm, big, shiny.

Egg cells, grown from your own skin for timeless offspring, planted in brand new fallopian tubes, fertilised with sperm from your own genome, so that you can always only remain yourself, only you, only you, only yourself.

They will give you anaesthesia now. You only see their little dark eyes, their faces behind their masks. Your heart on the monitor. Your naked body.

The countdown.

A syringe.

Do not be afraid: we will find a suitable body for your head.

Do not be afraid: we know today what we did not know yesterday.

Do not be afraid: your inheritance will continue to live.

Do not be afraid: your brain is being cooled by quantum-controlled refrigerators.

Do not be afraid: you will not die. We only cut parts of you, and replace them with new ones. We keep your soul, and transplant it into a new existence.

Do not cry. That makes no sense.

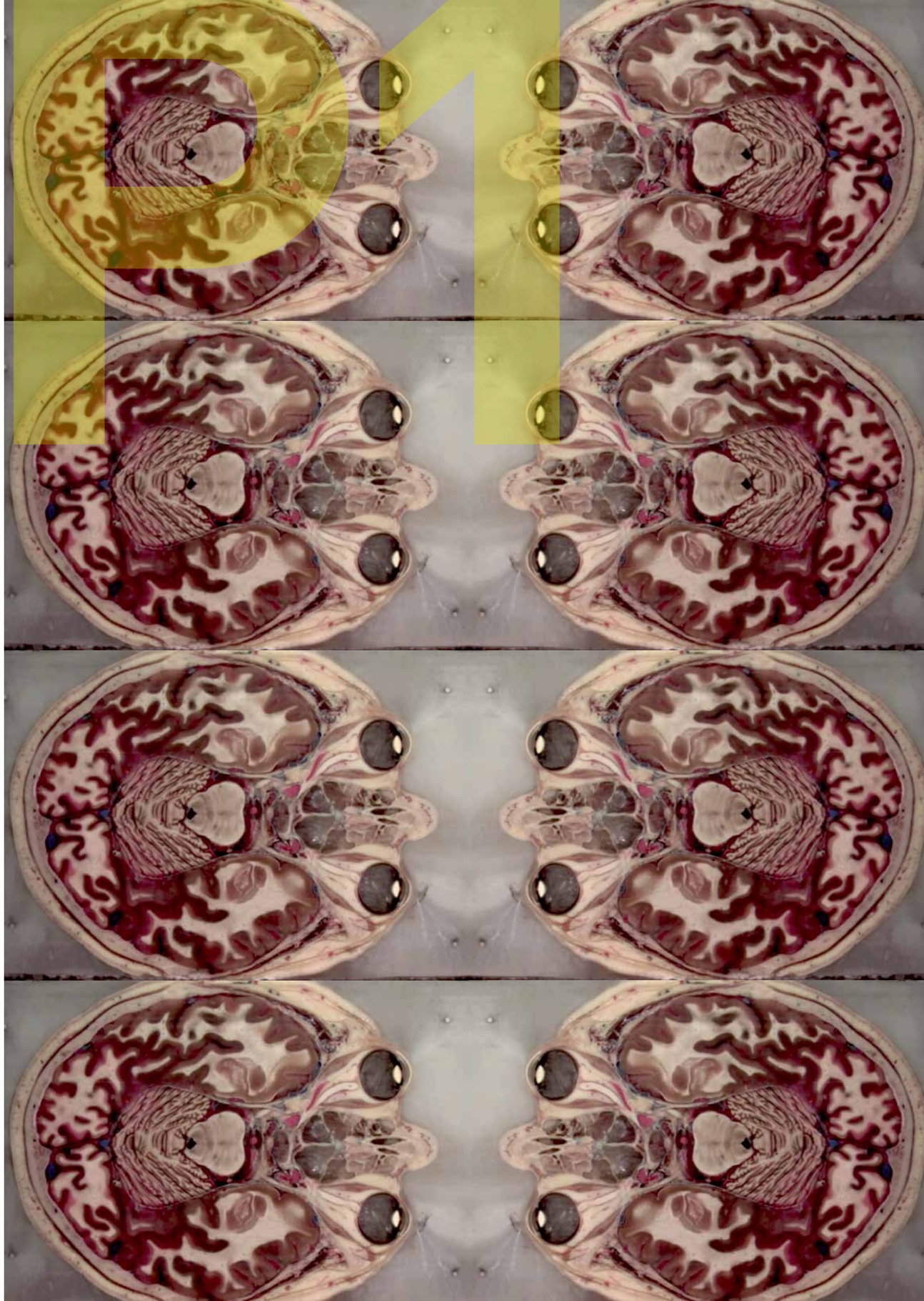
A scalpel.

Your liver for the eagle, Prometheus!

Radio Frankenstein examines today's scientific and technical possibilities of modification, manipulation, and creation of human bodies, projects this into the near future and asks how these possibilities and their implementations relate to fairness.

Radio Frankenstein focuses on which "price in fairness" this will exact: Who has access to "improvements", and on whose budget will they go? Or, in other words, who or what decides which people do not have access to healing, enhancement, transplantation, human biotechnology?

Who loses? On what grounds? Who benefits? Based on which rights?



MARKUS ZOHNER
IN COLLABORATION WITH PHILOSOPHER NICOLE DEWANDRE AND MEDIA SPECIALIST PAULO ROSA

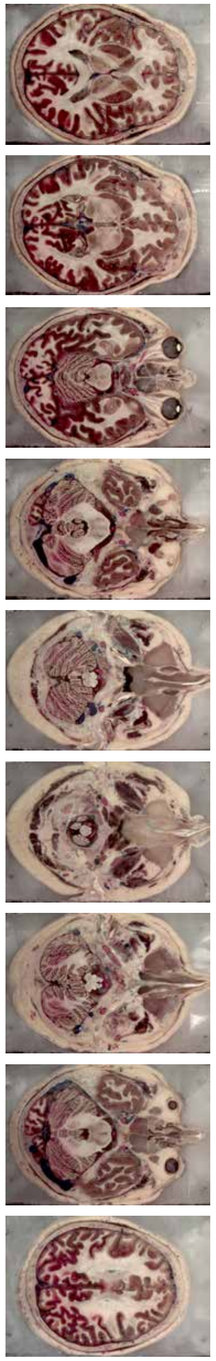
SCIENCE BEHIND

DIGITAL MEDIA SPECIALIST AND ENVIRONMENTAL MANAGER PAULO ROSA

Over the last decade, we witnessed what can be called "the rise of personal fabrication". The widespread availability and accessibility of personal fabrication technologies, in particular 3D printing, gave individuals the potential to manipulate atoms as easily as they manipulate bits. Nowadays, there are already various examples of 3D printers in the consumers' market and almost every day we hear news of 3D printers capable of printing an even greater variety of input materials, from plastic, metal and wood pulp to food and even biological tissue. Indeed, the idea of 3D printing human tissues and ultimately human organs for implantation has been pursued for some time. And even if this scenario can still be largely considered science fiction, there are already examples of 3D printed biocompatible materials, cells and supporting components that were assembled into complex 3D functional living tissues (for example, the 3D printing of calvarial bone, cartilage and skeletal muscle out of plastic-like materials and living cells belonging either to humans, rabbits, rats, or mice).

The main argument in favour of bio-printed organs is that they can have a direct impact on the lives of many patients, namely of those on the waiting list for transplants of vital organs. Moreover, as the cells for the fabrication of the 3D printed organs can come from a patient's own organs, it would no longer be necessary to take powerful and debilitating drugs to prevent the immune system from rejecting the new body parts. It is evident that 3D bio-printing is well-intentioned. However, it also raises a number of legal and ethical issues, from the current lack of regulation to the lack of adequate mechanisms to control the "quality" of the organs produced. Moreover, there is a potential for serious problems in regard to social inequality. We should be cautious as to whether technological advancement in this area will indeed be equally accessible in similar quality to everyone. Further, bio-printing might also be used as a tool to easily repair injured tissues and thus diminish our care for our own body. Or to enhance the performance of organs of, for instance, professional athletes, through the use of non-human cells. Spinning this through a little further, we quickly arrive at potential tie-ins of bio-printing with debates on enhancement and even transhumanism. This field of technological innovation thus opens up a range of questions from the availability of medical technologies to our understanding of what it means to be human and to be able to tinker with life itself.

The *Radio Frankenstein* project is a modern-stage adaptation of the famous novel. In this adaptation, the play is revised to incorporate novel technological developments, in particular the recent advances seen in 3D printing and bio-printing of human tissues and organs. The action revolves around the potentials of human tissue growth, 3D and bio-printing, manipulation of human genome, transplants of important organs and central body parts, and resulting debates on human enhancement and transhumanism.



RADIO FRANKENSTEIN

BIOGRAPHY

Born in Munich, **Markus Zohner** *lives in Lugano, where his theatre company, the Markus Zohner Arts Company, is established. Touring with the company all over the world in the last 30 years, he has staged shows and performances in Europe, Asia, North and South America and Africa.*
In 2002, Zohner founded the Markus Zohner Flying Theatre Academy for Central Asia, *organised for the first time in Almaty, Kazakhstan. In 2004, he started directing the* Theater am Brennpunkt *in Baden, canton of Aargau. Between 2006 and 2008, he developed the project* Kosovo Blood Theatre Project, *a cooperation with Quendra Multimedia and Jeton Neziraj in Priština. On 16 December 2008, Markus Zohner set out from Venice for a journey on foot. After crossing twelve countries in a journey of more than 4,000 kilometres, he arrived on 21 September 2009 in Saint Petersburg, Russia. He wrote a book and organised a photographic exhibition on this adventure: "Rediscovering the ancient Amber Road".*
In 2012, he launched the cultural and theatrical project C.U.T., starting with the podcast recordings of "C.U.T.! The Sense of Life – il senso della vita*". He organised the C.U.T.! APOCALYPSE 2072 | end.begin tour, with performances in Lugano.*
In 2013, he developed the project C.U.T.! LA COLPA – trilogia sulla fallibilità dell'anima umana *(C.U.T.! Guilt – Trilogy on the fallibility of the human soul), part of which is the C.U.T.! RADIO SCATENATA (C.U.T.! Unleashed Radio"), a radio project with prisoners of the LA STAMPA prison of Lugano.*
In 2015 he founded RADIO PETRUSKA – the first independent cultural podcast of the the Italian part of Switzerland.
He then developed the multiannual cultural project LA CREAZIONE DEL MONDO (The Creation of the World), posing 1,000 questions to famous scientists, to investigate our history, our origins, and our existence.
2016 saw the première, in Lugano, of the radio performance Cappuccetto Infrarosso *(Little Infrared Riding Hood).*

Paulo Rosa *holds a Ph.D. in Digital Media and a Master's degree in Environmental Management Systems, both from the New University of Lisbon. He is currently at the European Commission, in DG Joint Research Centre, working in the field of Science and Technology Studies. His research revolves around the governance of technoscience with focus on the societal implications; the engagement of citizens in science, in particular in citizen science and do-it-yourself (DIY) science; and the potential of the Maker Movement in democratising innovation.*
Paulo has strong hands-on experience in the design and development of innovative information and communication technologies focused on science communication, environmental education, and public engagement; the design and implementation of virtual citizen participatory methods; and the development of online interactive applications to extended governance initiatives in areas of risk governance and sustainability.

ANAÏS TONDEUR
IN COLLABORATION WITH GEOLOGIST FRANCESCO MUGNAI

La Fabbrica dei Terremoti

08

IS NATURE FAIR?

RESONANCES

The Ancients felt an awe for nature and saw gods in thunder and creek. The Romantics stood in awe at the Sublime. Now humans have provoked the Anthropocene. They have arisen as a geological force with the power of a tectonic movement. The weight of the water kept by our dams accelerates and intensifies the earthquakes. No longer spectators, we flirt with producing a new sublime of disaster and disruption, turning it again into beautiful photos. Is this fair? Is Nature fair?

ANAÏS TONDEUR
IN COLLABORATION WITH GEOLOGIST FRANCESCO MUGNAI

ART INSTALLATION

08

Ancient Nordic tales evoke the existence of Fenrisúlfr, the great wolf who intended to swallow the sun. Terrified by his strength, the gods had bound him to the slopes of a mountain with a magical fetter created from the breadth of a fish and the sounds of a cat's steps, a woman's beard and the dust of the apparition of a mountain. However, when Fenrisúlfr trapped in his invisible chains howled in anger, thunder rumbled under the earth like an organ deep beneath the ground. Walls shuddered and the soil fissured into deep fractures.

For long, earthquakes were perceived as the manifestation of behemoth forces or colossal storms raging under the crust of the earth. We now understand that most earthquakes are caused by the movement of the Earth's tectonic plates and the sudden release of an energy sometimes concentrated over millions of years at the interfaces of its fault lines.

Yet, as giants of a new mythology, our species participates, to all appearances, in the formation of some earthquakes. Certain anthropic activities mingle with the Earth's seismic forces to the point of triggering earthquakes. Geologists postulate that four major strands possibly contribute to the impact of this phenomenon: the extraction of natural resources (coal mining or oil drilling), the storage of important volume of water in dams, the drilling and injection of liquid into wells (fracking or waste disposal), as well as nuclear test and explosions.

In *La Fabbrica dei Terremoti*, we captured seven imprints of these human-induced seisms that shook the Earth over the last decades. In the basement of the JRC earthquake simulator, we replayed, as if on the surface of a miniature planet, a short sequence of the seven hundred twenty known seisms partially or fully caused by human activity. On the surface of our little earth of oceans, we triggered these earthquakes with the intention of intuiting, in the shadows of their seismic waves, the tremors of a world we have endangered, the pulse of the earth, which now imperils our lives.

These photographs thus invite us to reflect on the collective experience of living in a time humanity has become "equipotent to the world"[1]. Significant manifestations of mankind raised as a new telluric force, induced earthquakes sharpen our awareness of the delicate balance which binds human activities to the Earth's cycles[2]. Indeed, if this new geologic era has become our reality, if it is the sign of mankind's relative control and impact over his environment, it is also the sign of our weakness. A few decades ago, economists presented environmental disruption as externalities. If nature was seen as an essential component of our world, it remained distant from us. It was not considered as a serious limit to economical growth. Yet, the time we have entered jeopardises this distinction. Eco-geo-chemical processes have erupted at the heart of the political scene and our everyday life. Antithetical to a Cartesian mastery of nature, these photographs magnify how we are intrinsically part of the global loops of the Earth's retroaction and its atmospheric, biological, geological or oceanic cycles.

As natural phenomena manifest themselves in an increasingly violent way, the photographs from *La Fabbrica dei Terremoti* urge us to rethink the incrementing inequalities, which affect the most vulnerable people.

Indeed, if philosophers of the Enlightenment accused God, whose creative act had permitted the horrors of the Lisbon earthquake in 1755, who then is responsible for the two hundred and fifty thousand Haitians who died in the streets of Port-au-Prince? They disappeared in an earthquake of a much lower intensity than the Californian seism of 1989, known as the Loma Prieta. It is not a matter of comparing a tragedy to another tragedy. The aftermath of the 1989 earthquake along the San Andreas Fault counts material damages and fifty-seven human victims. But it is rather about considering how the economical, social, and political conditions lead to the profound lack of fairness in our present world. Human tragedies are incrementally entangled into the systemic folds of the planetary disturbance, putting at risk the poorest population and the most deprived territories.

A note on collaboration

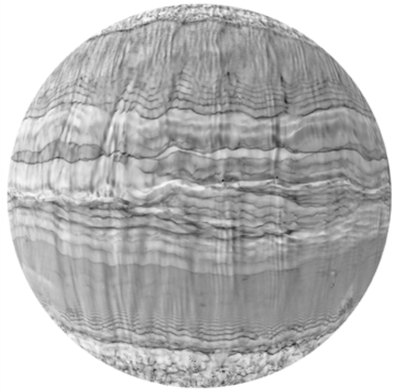
In this project, constructed in close collaboration with JRC seismologists, in a long process of experimentation and shared responsibility, these photographs highlight the importance of thinking together, beyond disciplines, in a collective intelligence that unites individual and expert knowledge in order to allow the emergence of a new ecological humanity.

Working with JRC scientists on these very current questions, deeply moved my practice.

My work has evolved for several years in an engagement for environmental concerns, yet this project anchored my research into the prevalence of their collateral consequences on human lives, stressing the need to take care of the earth so as to construct a world of lesser inequalities, the urgency to invent another relation to nature, and therefore to our own humanity.

> If this new geologic era has become our reality, it is also the sign of our weakness.

1 Michel Serres, *Le Contrat Naturel*, Paris, 1990, p.40 (own translation).
2 In 2008, it is considered the Chinese dam of Zipingpu modified the pressure of the contiguous fault by 1,650 feet resulting in an acceleration of the fault movement and an increase of the intensity of the earthquake which followed. 69,227 persons died in the aftermath of its seismic wave.



SCIENCE BEHIND

GEOLOGIST FRANCESCO MUGNAI

Our planet's weight amounts to something like 6,000,000,000,000,000,000,000,000 kg, i.e. six sextillion kilogrammes or six million billion billion kilogrammes, which would be the combined weight of about 100,000 billion billion human beings. Can we do better in presenting our case using height as a parameter? Not really: the Earth's circumference is about 40,075,000 metres. We could cover this distance by making a chain of people consisting of the entire Spanish population (about 40 million). The Earth's radius can be covered using the inhabitants of Rio de Janeiro, a human chain of about six million people.

Humankind seems so small, so insignificant, even so irrelevant on the Earth's surface, and yet, the minuteness of our size and height, when compared to those of the Earth, only accentuates the size of our impact on the environment. Does this sound trivial? It is, indeed.

The part of the environment that is influenced by human activities is called the Anthroposphere; its dimensions are determined by human activity. During the past century, this extent has dramatically increased and the Moon and Mars have also become parts of it. When we speak about earthquakes, we usually focus immediately on big events that provoked huge damages and losses, like Amatrice 2016, Nepal 2015, Fukushima 2011, or Kobe 1995.

Earthquakes are provoked by land vibration, almost always generated by rapid movement of the Earth's surface provoking ruptures. Some of these ruptures behave in a manner comparable to snapping a dry wooden stick with two hands or crumbling a biscuit in one.

The keyword is always energy, energy that was stored in tension between geological structures by tectonic plate movement, and which is suddenly released upon the addition of another small amount of energy. The ground snaps or crumbles.

It would be difficult for humans to store an amount of energy comparable to those generated by tectonic movements. Still, various types of energy transmitted to the ground by human activities could add a sufficient amount of energy and trigger an earthquake. Such human activities would include building water reservoirs, engineering coastal land accretion, moving land mass by quarrying, extraction of resources (including groundwater, coal, hydrocarbons and geothermal fluids), as well as tunnel excavation and injection activities. Injection activities include waste fluid disposal, hydro-fracturing (commonly known as hydraulic fracturing or fracking), water and gas return in geothermal plants, research experiments, gas storage, enhanced oil recovery and carbon dioxide storage. Last but not least, nuclear tests often induce local earthquakes.

Gas Extraction (Verden)

Nuclear Test (Nevada, USA)

Mining (UK Bolton)

Natural Earthquake (Fukushima 2016)

A note on collaboration

We used a laboratory test machine, called a shaking table, to visualise the unique waveforms of earthquakes. Simulating particular earthquakes in a receptacle filled with water makes the frenetic movement induced by an earthquake visible to the human eye. Visitors can thus see earthquakes in an entirely novel way that allows them better insight than did the classical visualisations – e.g. pictures of devastation and seismographic images.

We identified several waveforms of particular quakes presumably generated by different processes or sources. We replayed, with good approximation, the acceleration that was provoked by each unique earthquake's energy and unleashed on the ground below our feet. A thanks to Giacomo Ulivieri form ITEM spin off of the University of Florence, Tullio Ricci and Giuliano Milana from Istituto nazionale di Geofisica e Vulcanologia (INGV) Roma for data processing. A special thanks also to Pierre Pegon and the ELSA Reaction wall team that allowed us to use the facilities of the European Laboratory for Structural Assessment (ELSA).

08

BIOGRAPHY

Mankind seems so small, so insignificant, even so irrelevant on the Earth's surface, and yet, the minuteness of our size and height, when compared to those of the Earth, only accentuates the size of our impact on the environment.

Anaïs Tondeur *is a visual artist. She works and lives in Paris. Her artistic practice takes form at the point where disciplines meet. Crossing natural sciences and anthropology, myth making and new media processes, she creates speculative narratives and investigations through which she experiments other conditions of being to the world. For this, she searches for a new aesthetic, in the sense of a renewal of our modes of perception, and explores, beyond the separation of nature and culture, ways to disrupt the grand narrative of the Anthropocene.*

Her current interest in issues of deep time and the singularity of vegetal life has led her to work with geological processes, radiogenic phenomena and their socio-political implications.

Her protocols of research took her in expeditions at the frontiers between tectonic plates, across the Atlantic Ocean, in the Chernobyl Exclusion Zone or through sterilised soils of urban environments. Moreover, when she is not able to access her fields of investigation, she creates vehicles of fiction, travelling for her. She thus recently sent a dream to space, on board of the NASA OSIRIS REx spacecraft.

Anaïs Tondeur has collaborated with philosophers, anthropologists, geologists, oceanographers and physicists. She was artist in residence at CNES (National Space Studies Center, 2016), National Natural History Museum, Pierre and Marie Curie Institute during the COP 21 (2015, Paris), Hydrodynamics Laboratory, (CNRS, École Polytechnique, *2013-2015). She graduated from the Royal College of Art (London, 2010) after completing a Bachelor (Hons) at Central Saint Martin (London, 2008). Recipient of Ars Electronica Honorary Mention (2015), she has presented her work in institutions such as Centre Pompidou (Paris), Gaité Lyrique (Paris), GV Art (London), Bozar (Brussels) and Houston Center of Photography (USA).*

Francesco Mugnai, *born 1978 in Florence, Italy, is a geologist. Since 2015, he has been working as a scientific project officer at the Joint Research Centre of the European Commission, Ispra, Italy. He holds a Master's degree in Geology (University of Florence, Italy) and a PhD in Earth Science (University of Florence) and has also spent some time at MIT in Boston. He has more than 10 years of professional experience in crisis management and risk assessment, both in the private sector (for engineering consultants) and in the public sector (post-doc research activity at Florence University and the European Commission). During the post-doc period, he had the opportunity to make in-field experience in several countries, from Kyrgyzstan to Turkey, from Malta to China, from Ireland to Mozambique, from Canada to Kenya, dealing with environmental issues, participating in hundreds of international transdisciplinary projects. During his educational and professional path, he has always been attentive to integrate his knowledge with different disciplines and his research production, originally focused on geoscience, has easily branched out to engineering geology, automation, and robotics, as well as to awareness enhancement, communication, and art, producing peer-reviewed scientific papers, international patents, and various media publications. He is co-author, with Mario Costanzi, of the musical* Sebastiano all'Opera, *an evening show that teaches kids how to behave in case of disasters.* Sebastiano all'Opera *was staged at the theatre of the* Maggio Fiorentino *in 2015.*

FREDERIK DE WILDE
IN COLLABORATION WITH TOXICOLOGIST LAURA GRIBALDO

Mickey Morph

09

WHO DO YOU HURT?

RESONANCES

Science and technology have transformed our world, yet we have paid a price in pollution and global warming. Animals, too, have paid a heavy price. It is still a riddle the law cannot solve: we need to take life in order to understand life. Instead of using animals, our scientists are looking for a remedy by growing cells they can test on. This is what Mickey Morph asks, dreaming of a fairer world with science liberated from unfairness: Who do you hurt?

FREDERIK DE WILDE

IN COLLABORATION WITH TOXICOLOGIST LAURA GRIBALDO

09

Investigate
Disneyfication
from different perspectives,
to question and even
condemn.

ART
INSTALLATION

The relationship between nature, technology and cultural diversity.

Disneyfication, such as economic globalisation, tends to ruthlessly replace local variants, products, etc. Baseball hats, blue jeans, and sneakers become the uniform of teenagers in both Budapest and Bangalore, while Western TV shows promote the illusion of unlimited wealth. This process is not the same as the different artistic traditions that inform each other and freely exchange ideas. Cross-pollination with, and borrowing from, other cultures has enriched both Western and Third World arts (e.g. Gauguin in Tahiti). The Business culture from the disneyfication is different: the guiding principles are efficiency and profit; there is a tendency to omit both diversity and authenticity, with the risk of becoming, a self-centered culture, a monoculture. Art, on the other hand, essentially flourishes through contact with the outside world.

Hybridity and Mutation

The concept, in a nutshell, is that hybridity and mutation are forms of change with particular relevance to post-modern culture. A form of deconstruction. Without wishing to succumb to an overly simplistic view, this could also be said of art, because "lending" of form(s) and manipulation thereof is an integral part of the concept of rendering (mimesis) of a Likeness. In this way even the most accurate portrait in a particular form is a variation of "the original". These "mutations" also provide an excellent opportunity to investigate Disneyfication from different perspectives, to question and even condemn. Often, the (waterproof) legal framework around Disneyfication leaves little margin for developing a culture of shared and authentic experiences based on mass-oriented cultural references, if you can or cannot generate new meanings by law. From this point of view, *Mickey Morph_"Death of Diversity"* questions copyright laws.

What *Mickey Morph_Ch1m @ era* (bioart sculpture) wishes to present is specific: art that explores transmutation, investigates drastic change in shape and changes beyond the boundary of "natural" evolution, but "make–able" or altered evolution. Thanks to computer technologies, software and hardware (eg 3D printing of biomaterials), we can generate and print them (such as organic materials), and, who knows, create new types in the lab.

The concept of fairness is researched from a clash of different ideological/religious perspectives resulting in, for instance, iconoclasm and the destruction of cultural heritage.

This also is Fairness; the right to copy and recombine, the right to experiment, the right as an artist to fully enjoy the freedom of creation - and to fully exploit it. But *Mickey Morph* also refers to the – sometimes – necessary testing on animals, to the animal suffering in the laboratories, to the legal framework around it, the ethical awareness, supported by many scientists, of the need to do something about it. That is *Mickey Morph's* dream, at the intersection of art and science, mapping these ethical questions and experiments. And to transform and mutate them into something that confronts us with ourselves and the society we are living in and and evolving into.

SCIENCE BEHIND

MICROBIOLOGIST LAURA GRIBALDO

Every year, millions of experimental animals are used all over the world.

The number of animals used in research has increased with the advancement of science and development in medical technology. Every year, millions of experimental animals are used all over the world. The pain, distress, and death experienced by animals during scientific experiments have been an issue of debate for a long time. Besides the major concern of ethics, there are more disadvantages of animal experimentation like requirement of skilled manpower, time consuming protocols and high cost.

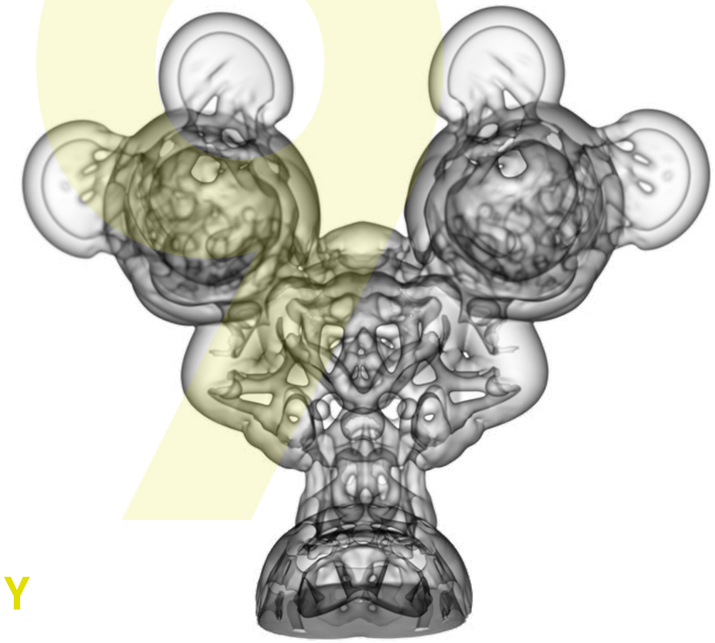
Chemical safety assessment has traditionally been based on animal testing but the EU has been promoting for many years the replacement, reduction, and refinement of animal testing. Furthermore, traditional risk assessment approaches are also considered insufficient to adequately predict the potential risk associated with any given substance, especially when considering normal-life low-dose exposure. Therefore, new prediction models are needed in a new intelligent and more efficient safety assessment, based on *in vitro* testing in combination with computational modelling.

The Regulation REACH on chemical substances (2006), the Regulation on Classification, Labelling and Packaging (CLP) (2008), the Regulation on cosmetic products (2009), and the Directive on the protection of animals used for scientific purposes (2010) are important examples of EU legislation that require, or strongly encourage, the replacement of animal testing. The EU policies on endocrine disruptors, combined effects of chemicals and nanomaterials are all examples of areas of concern where traditional risk assessment is coming to an end. New integrated methods based on in-depth biological knowledge are needed. Therefore, the JRC develops and tests new animal-free methods, alternatives to animal-based tests, to be applied in an integrated safety assessment of chemicals, and also provides informatics tools and databases to support this approach.

For example, JRC scientists have shown human-induced pluripotent stem cells (hiPSC) to be a promising *in vitro* model for neurotoxicity testing. These stem-cell-based systems offer an innovative human-relevant alternative to traditional animal tests that can improve the efficacy of drug discovery and support safety assessment. Neuronal models derived from hiPSC can be used to assess the activation of a biomarker of oxidative stress, the so-called Nrf2 signalling pathway. Oxidative stress is an important hallmark of various neurodegenerative diseases, including Parkinson's disease. Asthma is another example of disease that scientists are still trying to come to grips with, and where research has relied heavily on animal use.

A multidisciplinary approach, integrating a broad range of techniques from 3D cell cultures to mathematical models and using human patient data following a targeted and mapped out strategy, would not only reduce reliance on animals, but would also create a more scientifically robust asthma research field with a potentially more streamlined translation of research results from the bench to the clinic.

02



BIOGRAPHY

Frederik De Wilde *(Belgium, 1975) works at the interstice of the art, science, and technology. Frederik studied fine arts, media arts, and philosophy. The conceptual crux of his artistic praxis are the notions of the inaudible, intangible and invisible. An excellent example is the conceptualisation, and creation, of the* Blackest-Black art *made in collaboration with American universities and NASA. The project received the Ars Electronica Next Idea Award and the Best European Collaboration Award between an artist and scientist, extensively covered (e.g. Huffington post, Creators Project, TED). In 2017 De Wilde brings the* Blackest-Black art *to the Moon in collaboration with Carnegie Mellon (www.moonarts.org/about/team), NASA, Astro-Robotic and Space-X. De Wilde is a laureate and member of the Royal Belgian Young Academy (www.jongeacademie.be), is currently guest professor at the Artscience Interfaculty in Den Hague, collaborating with the University of Leuven (Prometheus, division of Skeletal Tissue Engineering), collaborating with Hasselt University (I-BioStat), University of Ghent (Textile Department), and many other universities (e.g. Wyoming University) and organisations (e.g. ESTEC), Max Planck Institute. De Wilde is currently finishing his first short film supported by the Flanders Audiovisual Fund (www.vaf.be/toegekende-steun/hoarder), produced by Potemkino, Bekke Films, Radiator Sales and post-produced by The Fridge. Studio De Wilde is currently represented by White Circle Agency (www.whitecircle.xyz) and Sedition (www.seditionart.com).*

Laura Gribaldo *MD, PhD in Microbiology and Virology, she has thirty years of experience in the field of testing for safety assessment. She coordinated several prospective validation studies, among others a study to evaluate a set of* in vitro *tests to detect immunosuppressant compounds. She had international collaborations with NCI (National Cancer Institute) and EPA (US Environmental Protection Agency) on myelotoxicity studies on new anticancer drugs and pesticides, worked as an independent expert in the validation of cell transformation assay, and as EC expert in the WHO/IPCS (World Health Organisation/International Programme on Chemical Safety)Drafting Group on Guidance for Immunotoxicity Risk Assessment for Chemicals. From March 2009 to October 2012, she had the leading role in setting up and managing a toxico-genomics platform for the development of standardised assays in safety assessment of chemicals and food. In 2010, she was responsible for setting up a new activity to support a programme ensuring agreement, harmonisation, and validation of procedures and methodologies in genetic testing to highlight the application of genomics for diagnostics purposes. Furthermore, she acted as scientific officer on Rare Diseases, networking and representing JRC at the EUCERD (EU Committee of Experts on Rare Diseases) meetings for the establishment of the European Platform for Rare Diseases Registries. Today, she is responsible for the work package on validation that aims at identifying promising alternative methods to animal testing, their scientific assessment, their eventual peer review and recommendation to stakeholders, and the promotion of their international acceptance and use. She has co-authored over ninety scientific publications and several presentations at congresses. She has huge experience in working at the interface between science and industrial development in an international regulatory context, with the proper background to bridge cell culture technologies, preclinical toxicological studies, clinical investigations and research.*

ANNEMARIE MAES
IN COLLABORATION WITH BIOCOMPUTATIONIST NÚRIA CONDÉ PUEYO,
TOXICOLOGIST LAURA GRIBALDO AND MEDIA SPECIALIST PAULO ROSA

Sensorial Skin for an Intelligent Guerilla Beehive

10

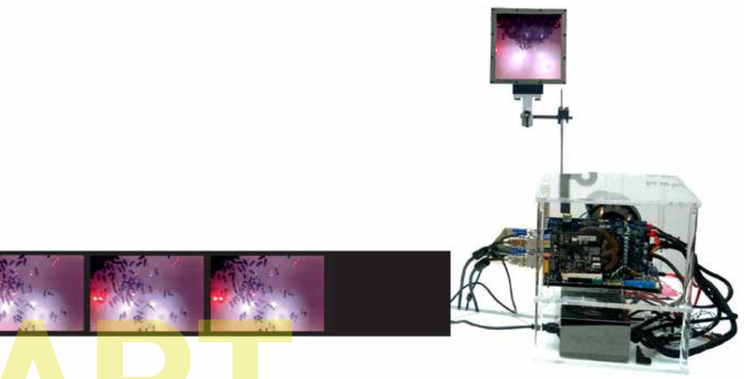
WHAT DO YOU CURE?

RESONANCES

4 500,000,000 years of life on Earth to arrive at this point: the first mass extinction provoked by a product of evolution itself – Homo sapiens. Each day species disappear, but with bees, we feel differently. Their role is crucial in the life of the plants, the flowers, and the trees that make up our habitat. The artist as the antenna of the race shows the way to a new science, a new Novum Organum, *that will require all the* Sapientia *of Homo sapiens: science and wisdom, knowledge and technology, art, complexity and emotion reassembled to save the bees. Will the question for good science become: What do you cure?*

ANNEMARIE MAES

IN COLLABORATION WITH BIOCOMPUTATIONIST NÚRIA CONDÉ PUEYO, TOXICOLOGIST LAURA GRIBALDO AND MEDIA SPECIALIST PAULO ROSA



Bees are bio-indicators. They reflect the health of their surrounding ecosystem as well as the cumulative effects of different pollutants.

ART INSTALLATION

The *Intelligent Guerilla Beehive* is a speculative research project that combines in a radical way smart materials, biomimetic forms and biotechnology. It is inspired by the intelligence, complexity and self-organisation of bee colonies as Super Organisms.

Sensorial Skin for an Intelligent Guerilla Beehive is a bio-art installation on the edge of art and science. It evokes issues of sustainability and biodiversity, giving viewers an artistic experience of my ongoing research related to the disappearance of the honeybee.

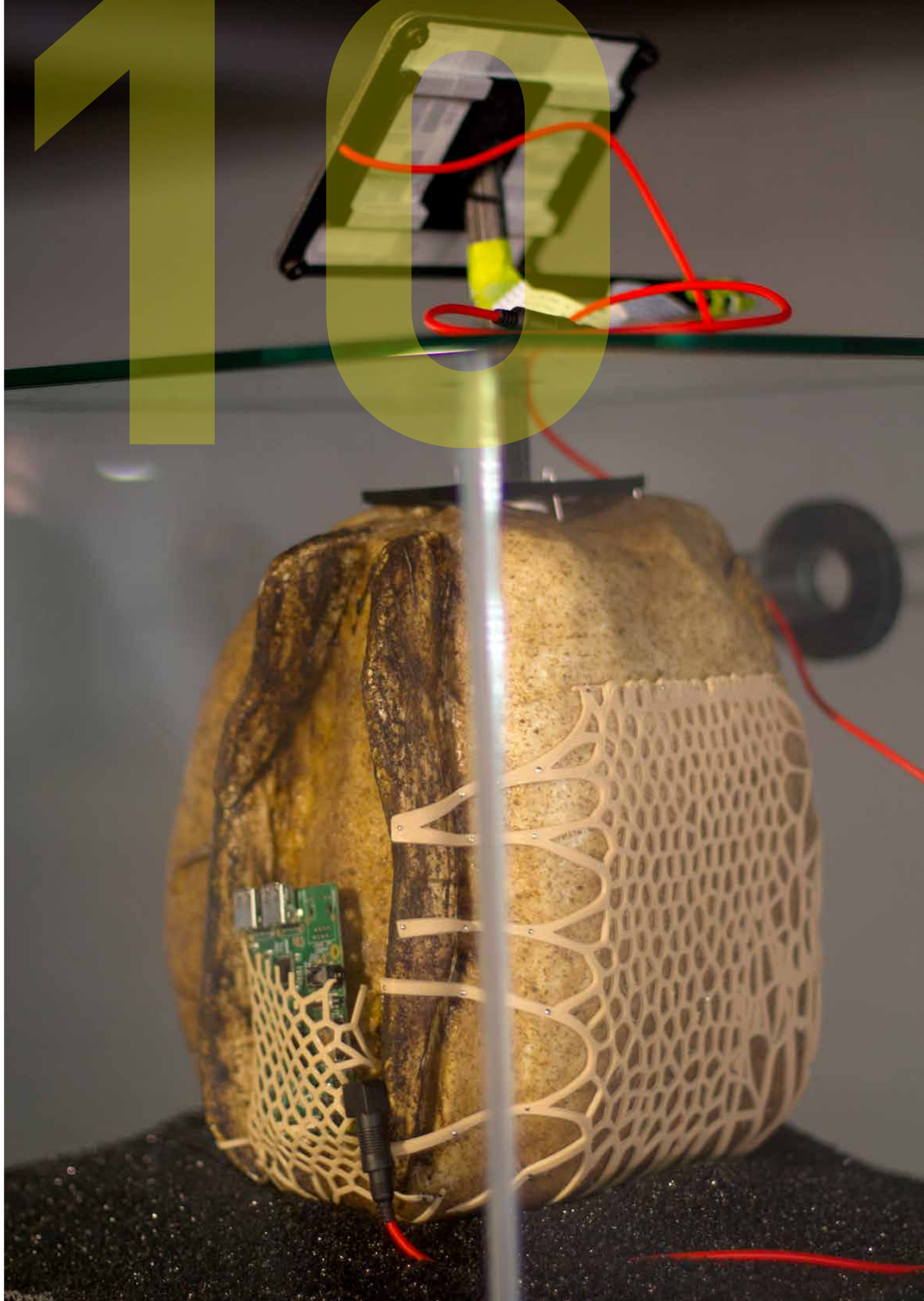
Bees are bio-indicators. They reflect the health of their surrounding ecosystem as well as the cumulative effects of different pollutants. Therefore, it is not surprising that in many industrialised nations bee colonies are now threatened. Pesticides and parasites are among the main factors, but equally worrisome are air pollution and the compromised state of the bees' foraging fields. To tackle the unfairness against honeybees, I developed a radically new beehive: the *Intelligent Guerilla Beehive*. This mobile shelter for swarming honeybees is designed for urban environments. It supports the bee colonies in their pollination tasks, and as a result compensates for the loss of biodiversity of their foraging fields.

The research and development of the device have also been a starting point for exploring possible futures through artistic experiments on materials science and biotechnology. The *Sensorial Skin* – the outer membrane of the *Intelligent Guerilla Beehive* – is a smart fabric grown by *Acetobacter* bacteria and yeast cells. It is augmented with a mix of organic and electronic elements for sensing and actuating, for computation and for communication. *Lactobacillus plantarum* bacteria living in a biofilm on the upper cellulose skin act as biosensors. When they sense a specific degree of pollution, they change colours and make patterns that reflect the environmental threats. The double-sided skin, wrapped on one side in a bacterial biofilm and on the other side covered by a pattern of porous stomata, also gives room to beneficial micro-organisms to attack the bees' natural enemy, the *Varroa Destructor* mite.

Most of the experiments were run in my "Laboratory for Form and Matter", where I work with a range of biotic and abiotic elements. I view my lab as an open environment for experimentation, a space for contradiction, criticism, and evaluation. I combine organic components such as vegetal matter, propolis, and chitine, with living systems such as fungi and bacteria. My micro-organisms grow biofabrics and I research how these membranes can be enhanced and made useful through embedded electronics and how more sensorial qualities can be implemented in these membranes via living technology. Navigating between blueprint and "Proof of Concept", the resulting prototype can be classified as "Future Archaeology": a fragment of a Forgotten World as well as a fragment of a World to Come.

A note on collaboration

My bio-art project - *Sensorial Skin for a Guerilla Beehive* - tackles a new challenging application domain where collaboration between human and non-human actors (bees, bacteria, other micro-organisms) is necessary to maintain the resilience of the system. We have, in the end, reached the anthropocene. We have to work on an ecosystem where all actors collaborate to keep up the resilience of the system. As artists, scientists, beekeepers, makers and thinkers, we collaborate with plants, insects and micro-organisms. With materials collected by the bees and with the help of bacteria the design of the *Intelligent Guerilla Beehive* comes into shape. In return for this support, the bees provide us with massive amounts of data and loads of information on the ecosystem that is hosting the *Guerilla Beehive*.



ANNEMARIE MAES

IN COLLABORATION WITH BIOCOMPUTATIONIST NÚRIA CONDÉ PUEYO, TOXICOLOGIST LAURA GRIBALDO AND MEDIA SPECIALIST PAULO ROSA

SCIENCE BEHIND

BIOCOMPUTATIONIST NÚRIA CONDÉ PUEYO

Annemie Maes' *Sensorial Skin for an Intelligent Guerilla Beehive* bio-art installation is a speculative project that provides a perfect framework to expand the limits of the applicability of biomaterials and biosensors research. At the same time, the huge global problem of the disappearance of bees offers a powerful way to disseminate these novel scientific technologies.

The research and development of the device has been a constant exploration on the edge of art, science, and biohacking. The goal is to provide a biological skin for a beehive, a skin that functions as an interface to compute and communicate the outer environmental and the internal beehive signals. For example, a modified *Deinococcus Radiodurans* is able to change colour when it senses air pollutants, but it is resistant to radiation and dry wheather. Such skin was conceived to be constituted by organic biomaterials, not only to maintain the coherence of the sustainability and the biodiversity narrative, but also to take advantage of much of the research done in the tissue engineering field. The initial idea was to create a "sandwich" of cellulose/chitosan/cellulose, allowing an outside cellulose layer to accommodate a sensing-biofilm and an internal cellulose layer to hold a designed microbiome. It contains, e.g., beneficial probiotic bacteria for bees (such as some *Lactobacillus*) or micro-organisms (genetically engineered if needed), able to detect or fight the *Varroa* parasite.

Thus, we have invested most of our efforts in experimenting with different technologies to create the skin with chitosan and bacterial cellulose. Our research has gone from 3D bioprinting with different percentages and mixtures of chitosan and purified bacterial cellulose, to develop a bioreactor for *Acetobacter xylinum*. A rotating device ensures the growth of a smooth layer of biocellulose covering the surface of the rotating beehive structure. We have also tested the growth of several *E.coli* strains, *D. Radiodurans* and non-isolated culture samples from forest beehives on the bacterial cellulose skins.

The final outcome (as exposed) presents a grown cellulose layer with x-gal, in which we have grown *Lactobacillus plantarum* able to change its colour to blue if parasites are present. This result acts as a proof of principle that demonstrates that our approach of creating a bacterial biofilm with colour in a biocellulose skin is feasible in a non-highly-scientific environment.

BIOGRAPHY

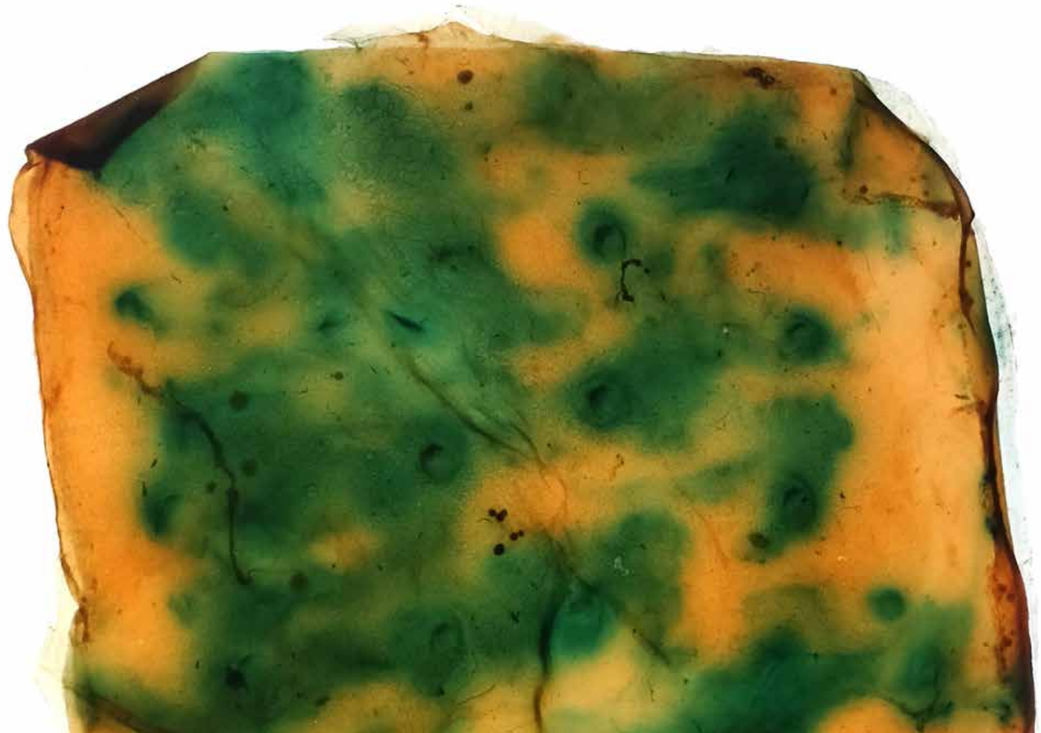
AnneMarie Maes *is an artist and a researcher. Her art meanders on the edge of biology, ecology and technology. Her research practice combines art and science with a strong interest for DIY technologies. She works with a range of biological, digital and traditional media, including live organisms.*

Her artistic research is materialised in techno-organic objects that are inspired by factual/fictional stories; in artefacts that are a combination of digital fabrication and craftsmanship; in installations that reflect both the problem and the (possible) solution, in multispecies collaborations, in polymorphic forms and models created by eco-data. In her Laboratory for Form and Matter *she studies the processes by which Nature creates form: the creation of honeycombs, how bees self-organise into swarms, how plants grow and form geometric patterns, how bacteria and yeast cells collectively create material surfaces forming biofabrics. She observes and analyses these processes, isolates them or causes them to appear in artificial conditions. She creates art works from this artistic research in many different media: installations and sculptures, video, audio, photographs and objects.*

Anne Marie Maes is a founding artist and director of several non-profit art collectives, such as Looking Glass, So-on, *and* Okno. *She has for decades been a recognised leader pioneering art/science projects in Belgium, using highly original ways to bring out hidden structures in nature by constructing original technological methods to probe the living world and by translating that in artistic creations.*

She has a strong international profile, having exhibited (amongst others) at Bozar in Brussels, Koç University Gallery in Istanbul, Borges Center in Buenos Aires, Arsenals Museum in Riga, Skolska Gallery in Prague, the Institute of Evolutionary Biology in Barcelona, the Designmuseum in Mons, the Wissenschaftskolleg *in Berlin,* Museum de Domeinen *in Sittard, Grey Area Gallery in Korcula, the OK Center for Contemporary Art in Linz (Ars Electronica), the Science and Technology museum in Milano. In 2017 she was awarded a Honorary Mention in the Hybrid Art category at Ars Electronica, for the* Intelligent Guerilla Beehive *project.*

Núria Condé Pueyo *is a post-doctoral researcher at Complex Systems Laboratory at Universitat Pompeu Fabra (UPF) in the PRBB (Parc de Recerca Biomèdica de Barcelona). She holds a Master's in biology and in engineering informatics; her research thesis dealt with biocomputation, that it is at the interface of both fields. At the moment, Nuria is the CSO of her health biostart-up (Moirai Biodesign SL) and teaches biology for architects, artists and designers at IAAC (Institute for Advanced Architecture, Barcelona) and GreenFabLab. She is also an active biohacker and founding member of DIYBio Barcelona.*



MARIO COSTANZI & CARLO FIORINI
IN COLLABORATION WITH GEOLOGIST FRANCESCO MUGNAI

The Sebastiano Experience

11

WHAT CAN WE DO?

RESONANCES

Let's fight climate change, to secure a decent life for our children, 50 years from now, at the other side of the Planet. Such thinking might be beyond the human animal, bound by his ancient horizon of now, tribe, and season. But we can at least learn and teach how to better handle today's thunder and floods, volcanoes and tsunamis. This could help us to embrace wider horizons, to find solutions for things to come. Are you ready? What can we do?

MARIO COSTANZI & CARLO FIORINI
IN COLLABORATION WITH GEOLOGIST FRANCESCO MUGNAI

ART INSTALLATION

How
to confront
natural disasters
in an intelligent way.

Fight fear so that you can acquire the serenity needed to confront Nature – she can be overwhelming, with a force that is many orders of magnitude greater than ours.

This is Fairness in The Sebastiano Experience. It is mastering the basic knowledge that enables us to deal with catastrophic events.

The breath of nature, the frequencies of geological events, the onset of disasters, the space between the before and the after… they all possess a rhythm that is frequently beyond time as felt by the individual, with its cycles of sunrise and sunset, or the cycle of seasons. They all are out of scale with the subject's experience, mostly inscrutable because these events can only be observed by taking into account orders of magnitude (wavelengths) that match those of civilisations and of centuries of human history.

The installation reflects this inequality between the time of the subject and geological time, investigating the trauma of disaster as the difference between the frequencies of events of the human condition and those of nature. Understanding this inequality is the beginning of the path to countermeasures and safety. The first step to this knowledge is not closing your eyes when confronting cataclysmic events, an experience the installation will mimic. It is strictly related to scientific data, as the sounds and images have been registered directly from the natural phenomenon itself. From this, a base algorithm is extracted and applied to the installation, allowing the sounds to by synthesised.

Themes

1. Collective memory - the times of mankind versus the memory of the environment - the times of nature: the representation on scale of the different frequencies.
2. Scientific knowledge versus community awareness:
   Science explains reality by means of method and inquiry. It describes phenomena by answering the question "What is it?", making the distinction between true and false. Consciousness, on the other hand, raises the question "Why?" in the desire to give meaning to reality, and "How?" in an attempt to dominate the effects of the catastrophe.
3. Narratives that socially metabolise the catastrophe:
   Scientific thinking, the theory that formalises a model of nature to explain the catastrophic event versus social thinking, the community that formalises a relationship with nature, the environment. To survive the catastrophic event and to develop survival strategies.

The *Sebastiano Experience* translates the songs of the show *Sebastiano all'Opera*, presented in the Opera of the *Maggio Fiorentino* in November 2015, into a happening demonstrating the same themes of the musical: how to confront natural disasters in an intelligent way.

Scientist Francesco Mugnai provided the data of historical catastrophes, informing us on their frequency and their characteristic wave-forms (transmitted energies, lengths, modulations and resonance). We generate background sound in scale: a low sound in the audible range superimposed with a high frequency of white noise, the former representing nature's time, the latter representing the simple existence of humans.

The installation has a highly tactile corpus of humble material, cardboard boxes, specially conceived to reproduce the relationship between the wave-forms of environmental events and those that represent humanity. The corpus takes the form of an object looming over visitors. It spreads the generated sound and captures the images projected on it. The visitor is thus confronted with a body vibrating with light and sound, immersing him/her in the experience of an earthquake.

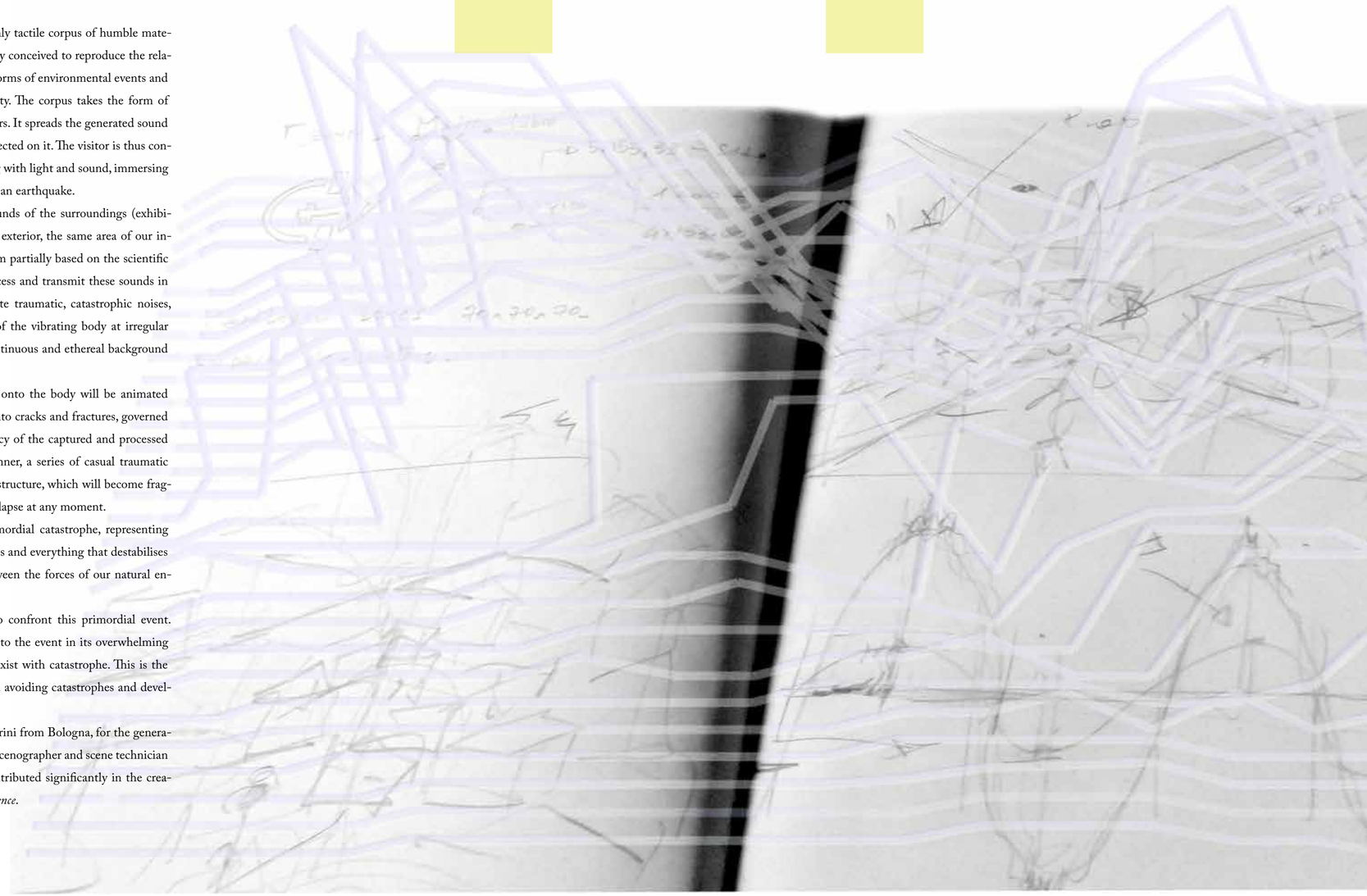
We also take over the sounds of the surroundings (exhibition spaces, their immediate exterior, the same area of our installation). With an algorithm partially based on the scientific data, we sample, trigger, process and transmit these sounds in real time. They help to create traumatic, catastrophic noises, diffused by the geometries of the vibrating body at irregular intervals over a minimal, continuous and ethereal background noise.

The geometries projected onto the body will be animated by vibrations. These evolve into cracks and fractures, governed by the intensity and frequency of the captured and processed sounds, creating, in this manner, a series of casual traumatic events. These impact on the structure, which will become fragile and unstable. Close to collapse at any moment.

This then becomes a primordial catastrophe, representing earthquakes, landslides, floods and everything that destabilises the normal relationship between the forces of our natural environment.

The visitors are invited to confront this primordial event. Doing so, they start relating to the event in its overwhelming power and find a way to coexist with catastrophe. This is the first and fundamental step in avoiding catastrophes and developing survival strategies.

The visual artist Carlo Fiorini from Bologna, for the generative and graphic art, and the scenographer and scene technician Daniele Spisa have both contributed significantly in the creation of *The Sebastiano Experience*.



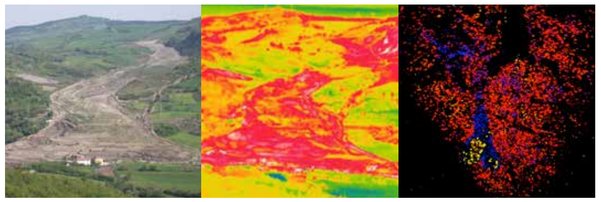
SCIENCE BEHIND

GEOLOGIST FRANCESCO MUGNAI

"Knowing better and losing less" is the subtitle of the 2017 *Science for Disaster Risk Management (DRM) report*[1], coordinated by the Disaster Risk Management Knowledge Centre of the European Commission.

The report provides reviews of scientific solutions and their practical use in various areas of DRM in Europe. One chapter is entirely dedicated to Disaster Risk communication and its importance in preventing and mitigating harm caused by disasters: how to prepare the population for a disaster, and how to disseminate information during and after disasters, including the recovery period. Disaster risk communication plays, in other words, a vital role during all four stages of the disaster cycle: mitigation and prevention, preparedness, response and recovery.

Technology and scientific research have made great steps forward during the last decades. Our society is now able to build shelters for landslides, to erect artificial barriers for fire and water and has developed innovative construction techniques to make buildings safer in case of seismic events.



Three different techniques to monitor landslide activity. Optical image on the left, Thermal image in the centre. RADAR interferogram on the right. (Pictures courtesy of the Department of Earth Science, University of Florence)

We also have very advanced monitoring and surveying systems combined with sophisticated early warning systems that can inform people of imminent catastrophic events.

Nevertheless, not all catastrophic events can be forecast or mitigated. With today's technology huge tsunamis cannot be blocked, neither can severe earthquakes, giant landslides or powerful cyclones.

What can we do then? How can we protect what we love, what we cultivate and construct, what we labour for?

The temporal dimension of natural processes, as well as their power, energy, and destructive capacity can be very different from how we perceive them. The gap between the real force and dimension of an event and how we live through it can be a key factor in building a safer world. A fair society must provide its citizens with the awareness and tools to deal with hazards on an equal footing. This is a challenge that requires congruence between science, society, and politics.

First of all, a thorough knowledge of the territory is a crucial aspect. In a desert, an earthquake will provoke very little damage, as will fire in a glacial environment.

Lava Flow during an eruption of Stromboli Volcano.

The main obstacle to a safer world is an understanding of how to manage the interaction between human activities and natural processes. In essence, this is easy: once you experience a catastrophe, you understand this interaction. Modern technology allows us now to simulate this knowledge virtually, through education and awareness-enhancing methods, passing on this rare understanding to people who did not experience an event.

With The *Sebastiano Experience* we want to give visitors the occasion to experience earthquakes in a virtual way, transforming seismic waves in safer vibrations that can be perceived without risks and combining them with appropriate lights and images.

The installation has been designed as part of the stage scenography for the *Sebastiano all'Opera* show, an educational musical aimed at enhancing children's awareness of risks. With these two initiatives, we can combat this particular form of unfairness and reinforce the DRM report's message: Knowing better IS losing less.

1 http://drmkc.jrc.ec.europa.eu/

11 BIOGRAPHY

Mario Costanzi *was born in Genoa on 3 February 1963.*
He has been writing music since a young age and has built a portfolio of over 200 compositions. He is also a producer and arranger, taking care of other artists' productions in the studio. He is a specialist in musical pedagogy applied to artistic performances.
He has a natural inclination to art applied to the social context, with events for children and young adults, as well as to management of training and group courses centered around music and socialisation. He is also very committed to local and grassroot projects. Cooperations, non-profit organisations and local administrations call on him for his capacities to combine music and social events, art and science, art and care, to promote their image and disseminate their values.
Past work includes: artistic co-direction and co-management for the World Youth Day with young adults from 22 countries of the world in the Siena Sports Hall in August 2000; Conception, artistic direction and management of the concert of renaissance and contemporary music Note di Colore *(Coloured Notes), on 1 March 2014, dedicated to the painter il Pontormo, Empoli Township and Uffizi Galleries, Florence;* Sogno di Volare *(Dream Of Flying) – Project on autism at the Festival of Mental Health – Florence, September 2014;* Leonardo allo Specchio *(Leonardo at the Mirror) and* Le 4 Chiavi *(The Four Keys) for the townships of Vinci, Florence, and the Union of townships of the Empolese-Valdelsa valley in Tuscany and many more.*

Carlo Fiorini (Visual Artist)
Born in Bologna on 1966 and Diploma on Electronic Engineering in 1985.
On 1988 he started his professional activity on economics and society developing statistics during the period of study on Political sciences. On 1992 Carlo started a partnership with University of Bologna developing a laboratory focused on "new media". His attention was focused on study the relationship between arts and new technologies. In the same period Fiorini participated to the foundation of MagNet, first Italian magazine on the Web (1993).
In 1994, within the co-operation with University of Bologna, he participated as editor in the BUP Bononia University Press. In 1997 he participated in the foundation of the "Museo del IX Centenario", first multimedia museum in Europe. As contents director he coordinated Design, integration in the training process, and the production of multimedia collection. In 1999 Carlo co-founded a production society for the communication of cultural heritage. Together with prof. Gianni Lorenzoni, in 2001 I participated to the foundation of AlmaCube, the enterprise incubator of University of Bologna, coordinating the set-up and communication.
In 2004 fiorini participated to the National Innovation Prize, placing himself second with the Sherpa project, for the development of radio-frequencies identification. As parallel activity he was developing software applications, set-up and multi-media production in several contexts.
In 2003 he started his artistic path as set designer, director, visual artist on theatres and art exhibition. Carlo Fiorini always looked for tradition and innovation, transferring experience on interactive and museum installations.

Francesco Mugnai *born 1978 in Florence, Italy, is a geologist. Since 2015 he has been working as a scientific project officer at the Joint Research Centre of the European Commission, Ispra, Italy. He holds a Master's degree in Geology (University of Florence, Italy) and a PhD in Earth Science (University of Florence) and has also spent some time at MIT in Boston. He has more than 10 years of professional experience in crisis management and risk assessment, both in the private sector (for engineering consultants) and in the public sector (post-doc research activity at Florence University and the European Commission). During the post-doc period, he had the opportunity to make in-field experience in several countries, from Kyrgyzstan to Turkey, from Malta to China, from Ireland to Mozambique, from Canada to Kenya, dealing with environmental issues, participating in hundreds of international transdisciplinary projects. During his educational and professional path he has always been attentive to integrate his knowledge with different disciplines and his research production, originally focused on geoscience, has easily branched out to engineering geology, automation, and robotics, as well as to awareness enhancement, communication, and art, producing peer-reviewed scientific papers, international patents, and various media publications. He is co-author, with Mario Costanzi, of the musical* Sebastiano all'Opera*, an evening show that teaches kids how to behave in case of disasters.* Sebastiano all'Opera *was staged at the theatre of the* Maggio Fiorentino *in 2015.*

MATTEO PIZZOLANTE
IN COLLABORATION WITH ECOLOGIST PIETER BECK

Oscillum

12

WHAT MORE WILL WE DISRUPT?

RESONANCES

Once upon a time, the old Messapi of Apulia, and later the Greeks, put up circular discs to protect their precious olive trees from bad spirits and evil gods. Now globalisation has brought the Xyllella bacterium *from Central America to prey on one of the oldest symbols of civilisation. We cannot wait for new science, we must act now. But we find we are still too slow in finding a cure. What more will we disrupt?*

MATTEO PIZZOLANTE
IN COLLABORATION WITH ECOLOGIST PIETER BECK

12

As hyperspectral images capture light in more than 150 “bands”, the human eye can never visually perceive all the information they contain.

ART INSTALLATION

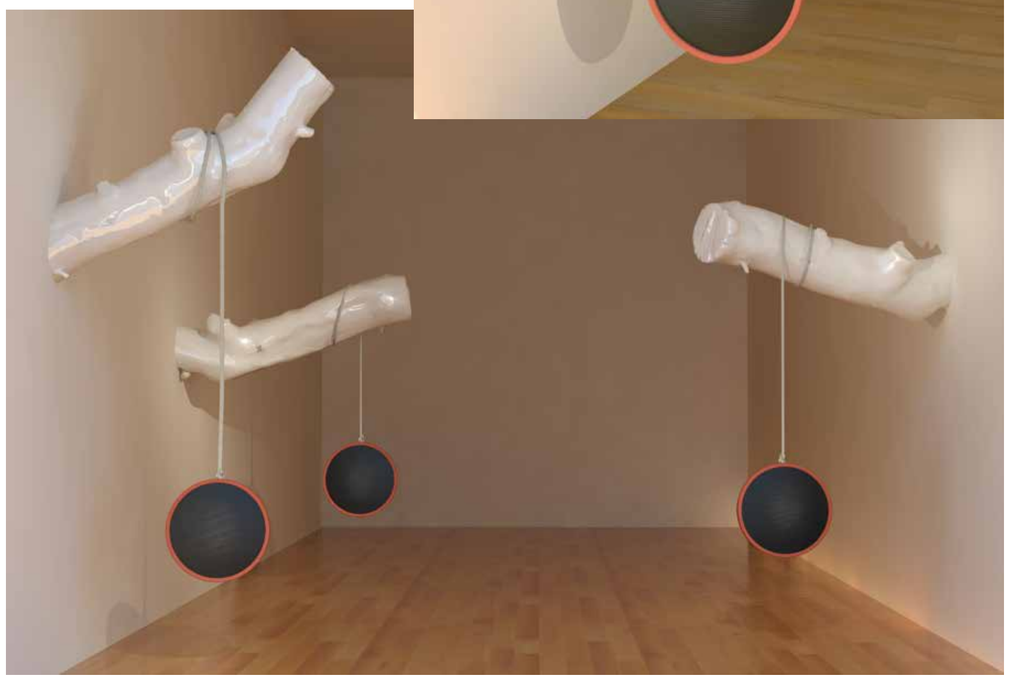
The project that we present faces a problem that broke out in late 2013. It is about a disease that is threatening the health of olive trees and the surrounding landscape in Salento (Italy). The phenomenon known as *Olive Quick Decline Syndrome* (OQDS) has been expanding irreversibly throughout the region and is now moving towards the north. The bacterium provoking it is called *Xylella*; it causes the drying up of olive trees and eventually their death. It has already caused an enormous damage to viticulture in California and beyond. The geographical distribution and the origin of these pathogens and related illnesses are to be found in South America.

The project entitled *Oscillum* is inspired by a widespread ancient Messapian custom. The Messapi were a tribe that inhabited southern Apulia from 8th century BC to 3rd century AD. The oscillum was a disk (about the size of a vinyl record) made of terracotta that was often decorated with a Dionysus mask or other traditional and religious symbols. It was usually hung up on a tree in order to foretell and protect the fertility of vines and olive tree fields.

The project was developed in close cooperation with the Laboratory for Monitoring Stress in Trees using Environment Remote Sensing (or "MonSTERS") at the Joint Research Centre in Ispra, Italy. The research group collects very high-resolution hyperspectral and thermal images on the field, permitting to analyse the state of health of individual trees. These high-resolution images reveal early stages of the disease that are invisible to the human eye. Humans see light mainly in shades of blue, green, and red; a digital camera captures and a computer monitor displays pixels of those three colours. As hyperspectral images capture light in more than 150 “bands”, the human eye can never visually perceive all the information they contain. As a compromise, we usually display only three of the bands in an image, or we display the entire signal measured for a single spot.

In this project, the technical data provided by the laboratory was converted into digital sounds. The *Oscillum* is the protagonist of the installation. It faces different aspects of the subject and talks about a territory that was left unchanged for centuries and that is now being subject to a massive destructive transformation.

The aim of the project is also to reflect on how art and science can work together and on the role of technology in our society. My impression is that my contribution helped the scientists connect with the reality on the ground: territory, trees, and people.



MATTEO PIZZOLANTE
IN COLLABORATION WITH ECOLOGIST PIETER BECK

SCIENCE BEHIND

PIETER BECK AND THE XYLLELLA TEAM:
YANN CHEMIN, BEGOÑA DE LA FUENTE,
MARGHERITA DI LEO, LAURA MARTÍNEZ,
GIOVANNI STRONA, PABLO J. ZARCO-TEJADA

> Along with the high-tech measurements, we wanted the piece to convey the emotion evoked by a landscape scattered with ancient, iconic, but dying, trees.

At the end of 2013, Italian authorities reported that the bacterium *Xylella fastidiosa* had been found in olive trees showing conspicuous drying of leaves and branches. *Xylella*, which naturally occurs in Central America, was not previously found in Europe, yet has been known to cause extensive damage to crops in Californian vineyards and peach orchards, as well as in citrus orchards in Brazil. Since those first findings, *Xylella fastidiosa* has ravaged olive groves in southern Apulia, Italy, an area where olive cultivation dates back to pre-Roman times. Because of the risk of damages across country borders, measures against pests such as *Xylella fastidiosa* are regulated at European level. To stop a disease that spreads as an epidemic, it is paramount that plants infected by the disease are spotted early, before they can infect others.

In the JRC's MonSTERS[1] lab we investigate whether olive trees infected by *Xylella fastidiosa* can be automatically detected in images taken with advanced remote sensing instruments from an aircraft. Hyperspectral sensors measure light not in red, green, or blue, like a standard digital camera, but in more than 100 very narrow ranges of light (so-called bands), capturing many different fractions of light between blue and infrared wavelengths. The hyperspectral images have the advantage that they allow us to estimate particular physiological properties of the plants, that might be directly related to disease effects. For each of the thousands of trees in the image, we can extract indices related to the structure of its crown, such as leaf abundance, and to the concentrations of different pigments in its leaves, such as chlorophyll and carotenoids. It also allows us to estimate "chlorophyll fluorescence", a phenomenon that sees plants actually emit a small amount of light, and is associated with photosynthesis. *Xylella fastidiosa* enters plants through the leaves when insects carrying it feed on plant sap. The bacterium then can reproduce inside the plant, ultimately clogging up its water vessels, affecting the plant's ability to pull water from its roots to its leaves, where this is needed to allow photosynthesis. Changes in photosynthetic pigments, or side-effects of photosynthesis itself, such as fluorescence, might thus be a direct consequence of early stages of *Xylella fastidiosa* infection.

Alongside the hyperspectral sensor, we have installed a thermal camera on the aircraft. This camera allows us to take the temperature of individual tree crowns; trees that are unable to transpire water from their leaves will not only struggle to assimilate carbon through photosynthesis, they will also heat up, because, just like transpiration on people's skin, transpiration cools down leaves.

For each tree, we extract these physiologically meaningful parameters, allowing us in many cases to diagnose whether an olive tree is infected by *Xylella fastidiosa*. With the right sensors on board, aircraft campaigns could thus be used to support the monitoring of large areas at risk of *Xylella fastidiosa* outbreak, a task which is now done from the ground and is very labour-intensive. Furthermore, our most recent results indicate that by analysing very high-resolution hyperspectral and thermal images of trees, we are able to detect symptoms of *Xylella fastidiosa* infection before they are visible to plant pathologists. This very promising finding suggests that advanced remote sensing methods can contribute to the critical task of early detection of *Xylella fastidiosa* infection.

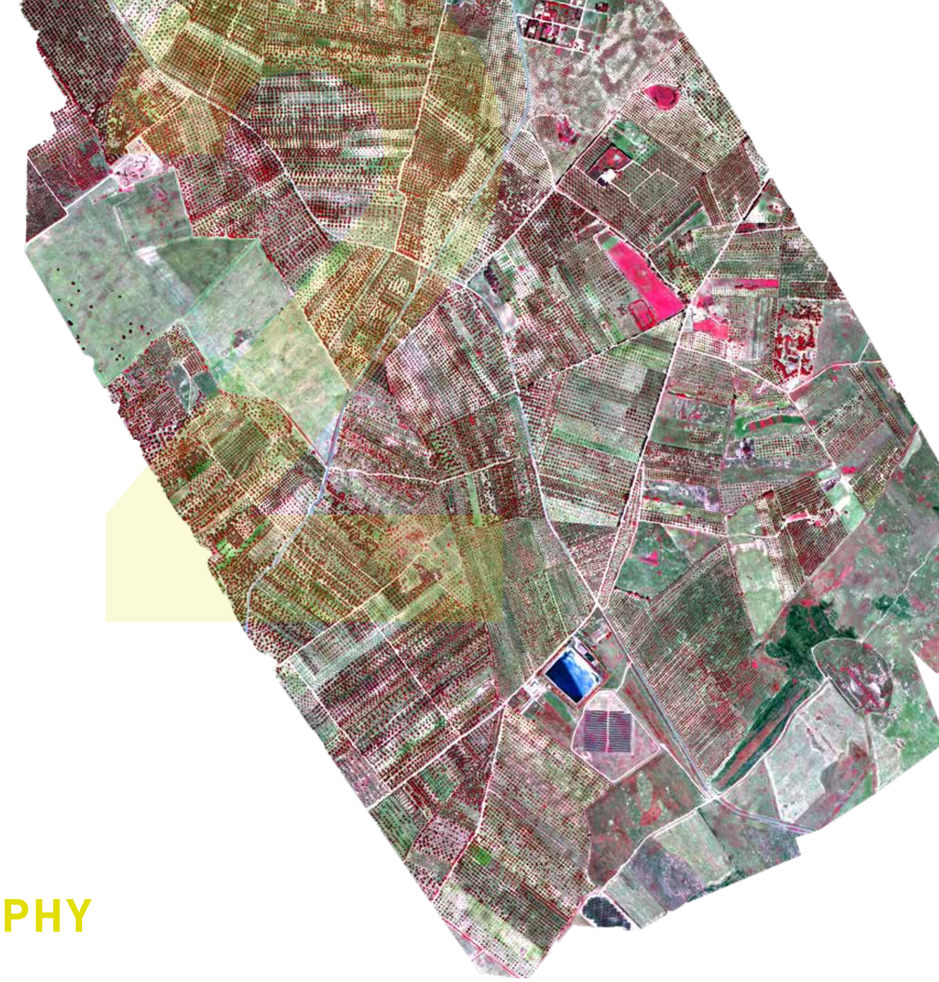
A note on collaboration

The collaboration with Matteo took the form of a series of meetings where we explained our scientific process and exchanged the latest findings from our remote sensing analysis for a sensations-centric point of view. Our discussions were sometimes animated, with us, as scientists, guarding the rigour of data we had so carefully collected, and Matteo inviting us to look beyond our comfort zones. The result hopefully brings you closer to our research and to his homeland.

Working closely together, we explored how we can convey the multiple dimensions of scientific research – the information we capture across the electromagnetic spectrum, the differences between individual trees depending on how badly they are infected by *Xylella fastidiosa*, and the subtle, but persistent, link between the radiation coming off a tree's crown and its health status.

Together, we landed on sound. Translating the electromagnetic light and thermal waves we had measured into sound waves, makes audible some of the information we cannot see. Along with the high-tech measurements, we wanted the piece to convey the emotion evoked by a landscape scattered with ancient, iconic, but dying, trees. With family ties to the Apulia region hit by *Xylella fastidiosa*, Matteo sought to capture, in his work, the damage that is done not only to the olive groves but also to the people that have cared for them, and harvested them, over generations. The *Oscillum*, with its historic role in both olive cultivation and people's perceptions of the natural world, provides both a tangible link between the physical manifestation of the *Xylella* epidemic in Puglia and its societal impact.

1 MonSTERS stands for *Monitoring Stress in Trees using Environmental Remote Sensing*.



BIOGRAPHY

Matteo Pizzolante *was born in Tricase, Italy, in 1989.*
He graduated from the Polytechnic University of Milan in Construction Engineering (September 2012) and afterwards he attended a Master's Degree Programme at the Brera Academy of Fine Arts in Milan with Prof. Vittorio Corsini. In 2015 he moved to Dresden to complete his studies at the Academy of Fine Arts with Professors Wilhelm Mundt and Carsten Nicolai.
He has participated in several group exhibitions in Italy and he was among the winners of the On the move 2015 competition held by the Pubblicità Progresso Foundation.
Matteo Pizzolante returns his gaze to the contemporary through new trials in the field of sculpture and site-specific installations, as well as by using different materials and processes.
In his latest series of works Pizzolante uses different media, from analogue photography to digital 3D modelling. He creates installations where images and objects characterised by temporal ambiguity meet each other in peculiar and mysterious spaces.
SELECTED GROUP AND SOLO EXHIBITIONS
2017 Premio San Fedele 2017, Galleria San Fedele, Milano
2017 Perfect Escapism - Studi Festival #3, Current, Milano
2016 Interstizi, Fondazione Bandera per l'Arte, Busto Arsizio (VA)
2016 Jahresausstellung 2016/Klasse Mundt, HfBK, Dresda, Germania
2015 Gaudete, Festival Internazionale di Musica Antica, Seminario Arcivescovile, Vercelli (VC)
2013 Chromo Sapiens, Florence Design Week, Archivio di Stato, Firenze
2013 Premio Ghiggini Arte Giovani, 2013, Galleria Ghiggini, Varese
2013 The New Florence Biennale, Kunstkammer In Progress, Ex tribunale di San Firenze, Firenze

Pieter Beck *is an ecologist who specializes in the remote sensing and modelling of vegetation, particularly in forests. He studies the effects that disturbance and climate have on the phenology, distribution, and carbon dynamics of vegetation as well as the associated land-atmosphere feedbacks.*
Pieter holds a doctoral degree from the University of Tromsø (Norway). Prior to joining the JRC in December 2013, he worked at the Woods Hole Research Center in Massachusetts (USA), ranked the world's most influential climate change think tanks for four years running. He has authored more than 40 peer-reviewed scientific articles, thanks, among others, to funding he secured during his time in the US from NASA, NOAA National Oceanic and Atmospheric Administration), and the NSF (National Science Foundation).
Pieter was a contributor to the European Atlas of Forest Tree Species and, since the beginning of 2017, leads the JRC's research group on forest information in Europe. In the last years, his research has expanded to include tree pests that are of particular concern to the EU, and most prominently the Xylella fastidiosa. *In this context, he leads the remote sensing work package in the H2020 XF-ACTORS consortium investigating* Xylella. *In this project, his team collects and analyses very high resolution remote sensing data from aircraft to better detect and understand the spread of the pest in trees.*

KIM DE RUYSSCHER, EVELINA DOMNITCH AND DMITRY GELFAND

SCIART AND SCULPTURE RESONATING WITH THE ENVIRONMENT

Double Ocean

13

WHERE WILL WE STOP?

RESONANCES

The compelling still of rock combining with the free flow of water, in a rhythm repeating the history of the earth. Here is a double ocean, the element from which life arose. Our oceans are delicate and fragile, yet we turned them into waste bins, filled to their depths with plastic. Reflecting on the womb all life came from, with dying coral reefs and minuscule plankton full of microparticles, the question becomes urgent: Where will we stop?

KIM DE RUYSSCHER, EVELINA DOMNITCH AND DMITRY GELFAND

SCIART AND SCULPTURE RESONATING WITH THE ENVIRONMENT

ART

INSTALLATION

EVELINA DOMNITCH – DMITRY GELFAND

KIM DE RUYSSCHER

> The sculptor as translator,
> who raises
> the unknown to the known.

Repeatedly our unfairness to the natural environment arises from impenetrable ignorance. To understand the complexity and the startlingly unique history of our living climate-whirling ocean could be a task too daunting to ever be accomplished. So, are we doomed to always harm other sentient beings and their inorganic substrate of existence? Or shall we set an *a priori* limit to human geological scale activities since we cannot predict their outcomes? Shall we even question our fairness to the environment if we choose the well-being of our own kind as the main ethical *modus operandi*? What is the social, economic, and cultural space where one can entertain such questions?

This artwork proposes a dialogue between settled ideas about the world and the world's incessant movement and fluidity. A marble sculpture by Kim De Ruysscher exhorts a feeling of stillness, a frozen memory of an oceanic trace. The texture and composition of stone further emphasise its fluidity through its geological signature. Such signatures can be found in detailed sculptural elements at the limits of abstraction and realism, depending on our knowledge of natural elements. De Ruysscher's solidified trace of an ocean embodies a flowing aqueous environment created by Evelina Domnitch and Dmitry Gelfand.

The collaboration of De Ruysscher, Domnitch, and Gelfand, is an encounter between the domains of fine art and art-science. Despite the prominence of art-science throughout the history of fine art, there is currently a deep chasm dividing these communities. Instead of perpetuating this segregation, the authors have decisively combined their creative efforts to reestablish a meaningful conduit between these artistic practices. The project's scientific partner is geologist Francesco Mugnai, who worked with De Ruysscher on elucidating the oceanic signatures of various stone species.

Our common goal was to create a dynamic system of circulating liquid amid a background comprised of a far slower geological imprint of ancient flows. From this starting point emerges the title of the work - *Double Ocean*. It can also be imagined as a miniature Earth and the oceans that envelop it.

> Shall we even question
> our fairness to the environment
> if we choose the well-being of our own kind
> as the main ethical modus operandi?

Giving the unknown a chance, to help man reacquaint himself with the unknown, is, in my eyes, one of the challenges that the concept of fairness demands.

The sculptor as translator, who raises the unknown to the known, can show us rich lodes of stones and rock that have a life of their own. He can show us the traces of the past that contain surprising messages for the present or the future.

In the work *Double Ocean* we find fairness back in rock, in age-old marble that has built its own history and that can reveal its own world in another unfamiliar form, different from its original state in the mountains.

The sculpture is a translation of a particle of the ocean, an apparently flimsy particle that nobody would normally take into consideration but that suddenly gets full recognition and can finally be shared, openly, with the spectator.

A small little-known fragment of reality suddenly gives the concept of Fairness a new opportunity: to accost us and question us.

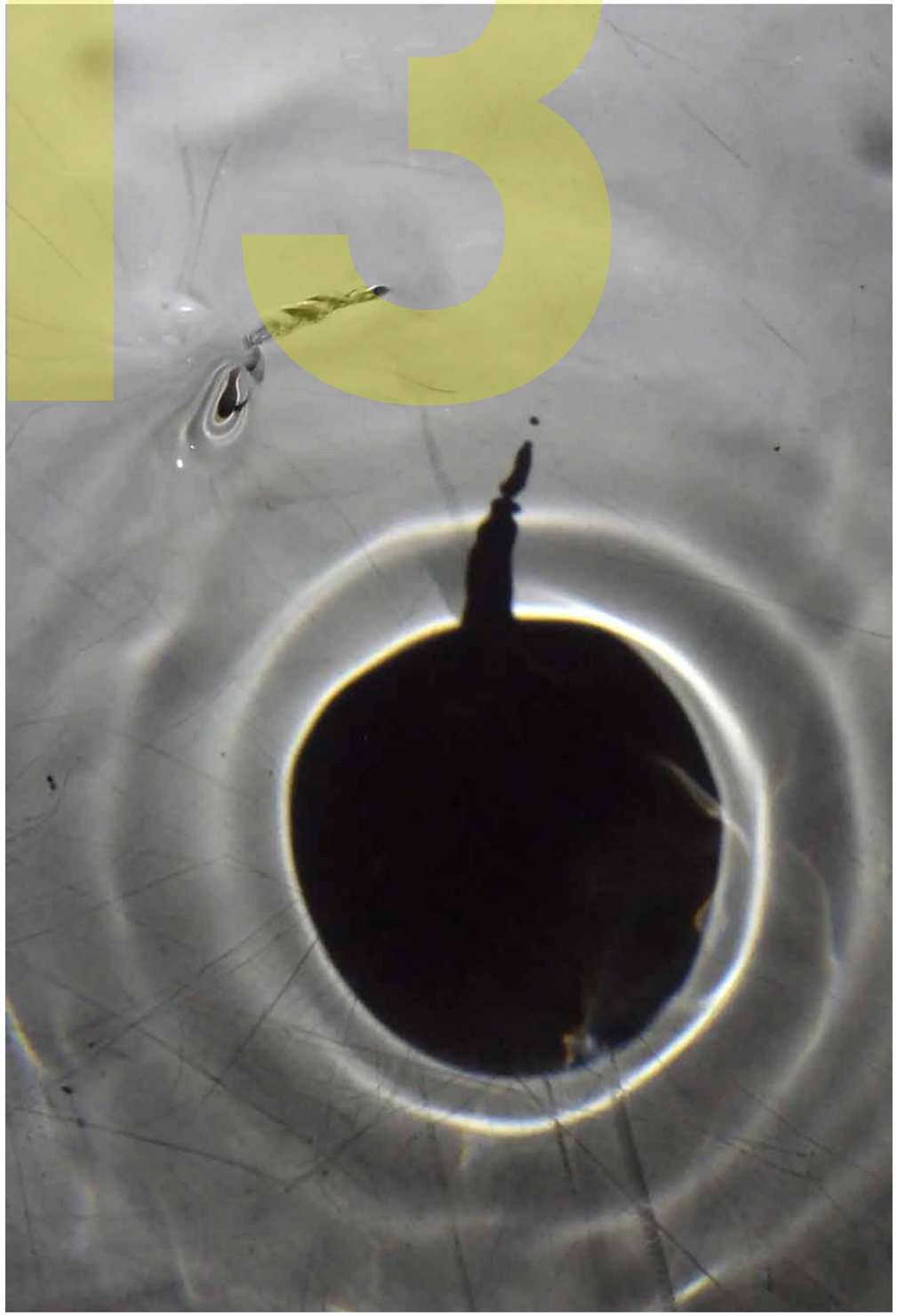
We can connect the ocean to movement. When we think of movement, we can also think about the concept of time. Time we can then relate to history or the concept of a track.

The traces of the ocean tell us a story in their imprint in geology, fossils in natural stone where they become anointed and cherish silent secrets. A fragment of these traces are fixed by Kim De Ruysscher in marble.

By adding the transformation of the alienated new sculptural element to the bare marbled marble there are opportunities for questions to the spectator.

The reality has now been drawn from its own original context and has a new home with its own language, where detailing, or even sculpted elements contributing to the reality of the ocean's trail, give us answers.

The ocean, full of stories and secrets, determines our lives and draws out the dependence and harmony of our lives, asks for fairness, an approach that gives the viewer access to the taking of knowledge and expresses the added value of knowledge for the benefit of the ocean.



SCIENCE BEHIND

EVELINA DOMNITCH – DMITRY GELFAND

Initially we wanted to introduce extra heat into the system, so that a temperature gradient procures currents and other dynamic phenomena. Since the fast rise of global temperatures has been a steady trend for decades and even centuries, we thought that it can be an intriguing premise. However, our experiments did not produce promising results. The heat was added via thermal elements and was very difficult to control. Dissipating excessively into the surrounding environment, the heat propagation utterly defied our attempts to localise it. If the heating was too fast, the stone would crack and its liquid contents would leak out. On our scale of operations, such an approach was not very practical for reaching the desired dynamics, and the adverse effects were inescapably significant.

At this juncture of unsuccessful yet enlightening experiments of heating the planetoid, we abandoned this diabolical idea and decided to introduce circular motion. On a planetary scale, axial rotation shapes air and ocean currents, playing a significant role in heat distribution, climate and weather formation. In *Double Ocean*, we create a central vortex to represent the enormous power of the Earth's axial rotation. However, there are many more doubles that are lurking beneath the ocean surface. For example, the physical characteristics of our planet suggest the formation of two loops of deep ocean circulation: symmetrical closed loops coming from the poles and coiling back at the equator. There is even a hypothesis that such a circulation pattern existed in the planetary past. Today, however, we observe a single loop circulation of the deep ocean, which takes about a thousand years to make one full loop. This circulatory current is essential for oceanic life in so far as it mobilises nutrients and stabilises the climate. The top hundred meters of ocean currents are additionally driven by entirely different processes, such as wind, atmospheric dissipation of heat, heliocentric rotation and tides. In recent decades, researchers have witnessed the weakening of both types of ocean circulation: the slowing down of deep ocean circulation and a roughly 30% deceleration of the Gulf Stream. It is extremely difficult to predict the effect of the disruption of deep ocean circulation at any unique moment in history, but if we look back at some devastating periods of rapid climate change in the past, we can single out the period of Younger Dryas, 12,900 to 11,700 calendar years ago. The main theory explaining the dramatic 2-6°C temperature drop and 7.5 meter sea-level rise is the shutting down of the deep ocean circulation belt.

GEOLOGIST FRANCESCO MUGNAI,
IN COLLABORATION WITH
PROF. LUCIANO CIPRIANI
(UNIVERSITY OF FLORENCE)

The artwork is based on a huge marble slab. The origins of marble are strictly linked to ocean dynamics unfolding over millions of years. Even if rocks are lifeless, and usually considered as unchanging material, they too undergo processes of genesis and alteration. Rocks can originate from small shells that are, over millions of years, compacted and transformed in a thick layer of sedimentary rock. Or they can be formed through the so-called subduction process, a geodynamic process where one plate moves under another and is forced down or sinks due to gravity into the Earth's hot mantle. Huge pressure and high temperature in the deep strata of the earth crust can transform these layers into metamorphic rock. If these layers are melted in the mantle, they can be transformed, on cooling, into igneous rock.

Indeed, almost all the rocks forming the planet can be classified in these three categories: sedimentary, metamorphic, and igneous.

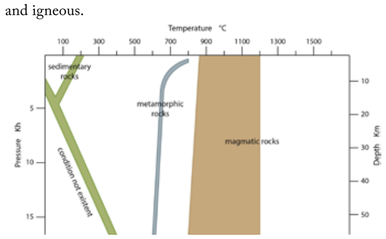


Diagram of rock transformation.

Marble is particular as it is the result of the transformation of carbonate under whatever metamorphic condition. Different combinations of pressure and temperature always result in marble – no other rock has similar behaviour.

Carrara marble is special. Its crystals are so thin that, after carving and polishing, it acquires a translucent and silky aspect. It gets a very particular visual depth and when you caress the polished marble, you feel a very smooth surface. These characteristics made Carrara marble famous already in antiquity, and this was reinforced by Michelangelo Buonarroti, who preferred this marble to all other types. Anecdotes abound of his trips to Carrara in search of the best block that "contained" the statue he wanted to carve, such as his *Pietà*. Many contemporary sculptors still prefer this type of marble.

13

We observe
a single loop circulation
of the deep ocean,
which takes about
a thousand years
to make one
full loop.

BIOGRAPHY

Dmitry Gelfand *(b.1974, St. Petersburg, Russia) and* **Evelina Domnitch** *(b. 1972, Minsk, Belarus) create sensory immersion environments that merge physics, chemistry, and computer science with uncanny philosophical practices. Current findings, particularly regarding wave phenomena, are employed by the artists to investigate questions of perception and perpetuity. Such investigations are salient because the scientific picture of the world, which serves as the basis for contemporary thought, still cannot encompass the unrecordable workings of consciousness.*

Having dismissed the use of recording and fixative media, Domnitch and Gelfand's installations exist as ever-transforming phenomena offered for observation. Because these rarely seen phenomena take place directly in front of the observer without being mediated, they often serve to vastly extend one's sensory threshold. The immediacy of this experience allows the observer to transcend the illusory distinction between scientific discovery and perceptual expansion.

In order to engage with such ephemeral processes, the duo has collaborated with numerous scientific research facilities, including the Drittes Physikalisches Institut (Goettingen University, Germany), the Institute of Advanced Sciences and Technologies (Nagoya), École Polytechnique *(Paris) and the European Space Agency. They are recipients of the Japan Media Arts Excellence Prize (2007), and five Ars Electronica Honorary Mentions (2007, 2009, 2011,2013, and 2017).*

Kim De Ruysscher *(°1973) is a sculptor* par excellence, *trained in craft workshops including the* Accademia di Belle Arti *(Fine Arts Academy) and the* Scuola del Marmo *(Marble School) in Carrara. Significant in his oeuvre are technique and metier or craftsmanship. A large segment of his work consists of sculptures fashioned out of natural stone and other classical materials.*

Thanks to his mastery of sculpting, he manages to imbue his figures with enormous verisimilitude, perfect in their appearance. But this calculated perfection is reserved for banal subjects from daily life: a soccer ball, a pillow, balled paper, a toilet roll, or a sleeping bag. In this fashion, he creates an intriguing contrast between his expensive working medium, the time-consuming execution, and the transience of everyday existence. The content, materials and technology for the realisation of the images are in stark contrast with the consumer society in which we find ourselves: cheap plastic objects and fashion-related brands.

Kim De Ruysscher studied painting at the Sint-Lucas College *of Art and Sciences in Ghent. After his graduation he went to Carrara, Italy to specialise in sculpture (in marble) at the* Academia di Belle Arte *(Fine Arts Academy) and the* Instituto Professionale Industria e Artigianato Tacca *(Professional Institue of Industry and Handicraft). Having previously spent eight years in The Hague, he has been living in Varese, Italy since 2014.*

Nicola Luciano Cipriani *graduated in 1971 in Earth Sciences at Florence University and has been lecturing at that university for his entire career. He is the author of numerous scientific articles and two mineralogical books, as well as of one patent about a software-hardware system for optical microscope analysis. The university courses he taught comprise Mineralogy, Rock and Mineral Recognition, Evaluation of Environmental Impact, Sedimentary Petrology and Geology and Mineralogy, his favorite being Sedimentary Petrology. Most of his publications treat this argument as well as the patent on optical microscope analysis, the software-hardware system being applicable to all types of optical microscope rock analysis. He was coordinator of several research groups and retired in 2011. He was also scientific member for the Planet Life Economy Foundation (a non-profit organisation) and Chair of its Tuscany Delegation.*

Numerous publications of N. L. Cipriani treat sandstone petrology. With his research, he tried to rebuild the evolution of the North Apennine chain between the Eocene and today. He also did research in Turkey, Eritrea and Libya. Particularly in Eritrea, he studied the sedimentary sequence of geological layers, in which a Florence research team found, in 1997, a female skull of one million years old. The skull shows characteristics in between Homo erectus *and* Homo sapiens. *This discovery allowed to move the transition from* Homo erectus *to* Homo sapiens *500,000 years back in time. This important discovery was published in Nature.*

EVELINA DOMNITCH & DMITRY GELFAND
IN A DIALOGUE WITH PARTICLE PHYSICS

Memory Vapour

14

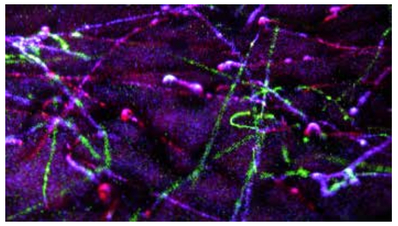
WHO WILL REMEMBER?

RESONANCES

In the end, where do we turn? Can it help to look up to the heavens and contemplate these stories of fair and unfair without fear? Unperturbed and beautiful, sublime in the stilled violence of the Hubble pictures, the cosmos penetrates our living cells, her influence on the life of this earth barely understood. She hints at an unreachable horizon, silent she is and cold, but fair. Before the silence of the stars, looking at our own extinction, may we ask: Who will remember?

EVELINA DOMNITCH & DMITRY GELFAND

IN A DIALOGUE WITH PARTICLE PHYSICS



ART

INSTALLATION

At this very moment, we are being bombarded by billions of charge carriers coming from every direction in outer space. The immense diversity of energy signatures corresponds to the scope of cosmic origins, ranging from solar emissions and those of other stars to hitherto uncharted physical processes at the edge of the perceivable universe.

Some of these cosmic bullets reach speeds that are a thousand times faster than anything ever launched at the Large Hadron Collider, and approximately once a year, a particle that is 10 million times more energetic arrives. Their origins are presumed to be supernovas and active black holes. One such candidate, supernova 1054, exploded so intensely that in the year from which it gets its name, Chinese and Arabian observers noted that it was bright enough to be seen in broad daylight for 23 days. Its remnants comprise the Crab Nebula. Significantly outlasting the timescale of stellar and galactic explosions, the highest energy cosmic rays unfold over multiple stages, entailing an accumulation of accelerative processes.

As soon as a cosmic ray reaches the ionosphere, the upper layer of our atmosphere, it ripples into a billion other particles, comprising a ubiquitous subatomic cascade. This cosmic shower can reach the senses by means of an experimental environment called a cloud chamber, invented by Charles Wilson in 1894 (perfected in 1911), to study the nucleation of atmospheric clouds – an idea that came to him during his mountaineering trips when he observed such phenomena as auroras and glories.

Recently, the Cloud Project at CERN and a multitude of parallel research groups have revealed the significant role of cosmic rays in atmospheric and biological processes. Variations in cosmic ray showers have been found to affect tree growth more than changes in temperature or precipitation. The phenomenon known as relativistic runaway electron avalanche, hypothesised to seed lightning, has been directly linked to decaying cosmic rays, as has the seeding of clouds.

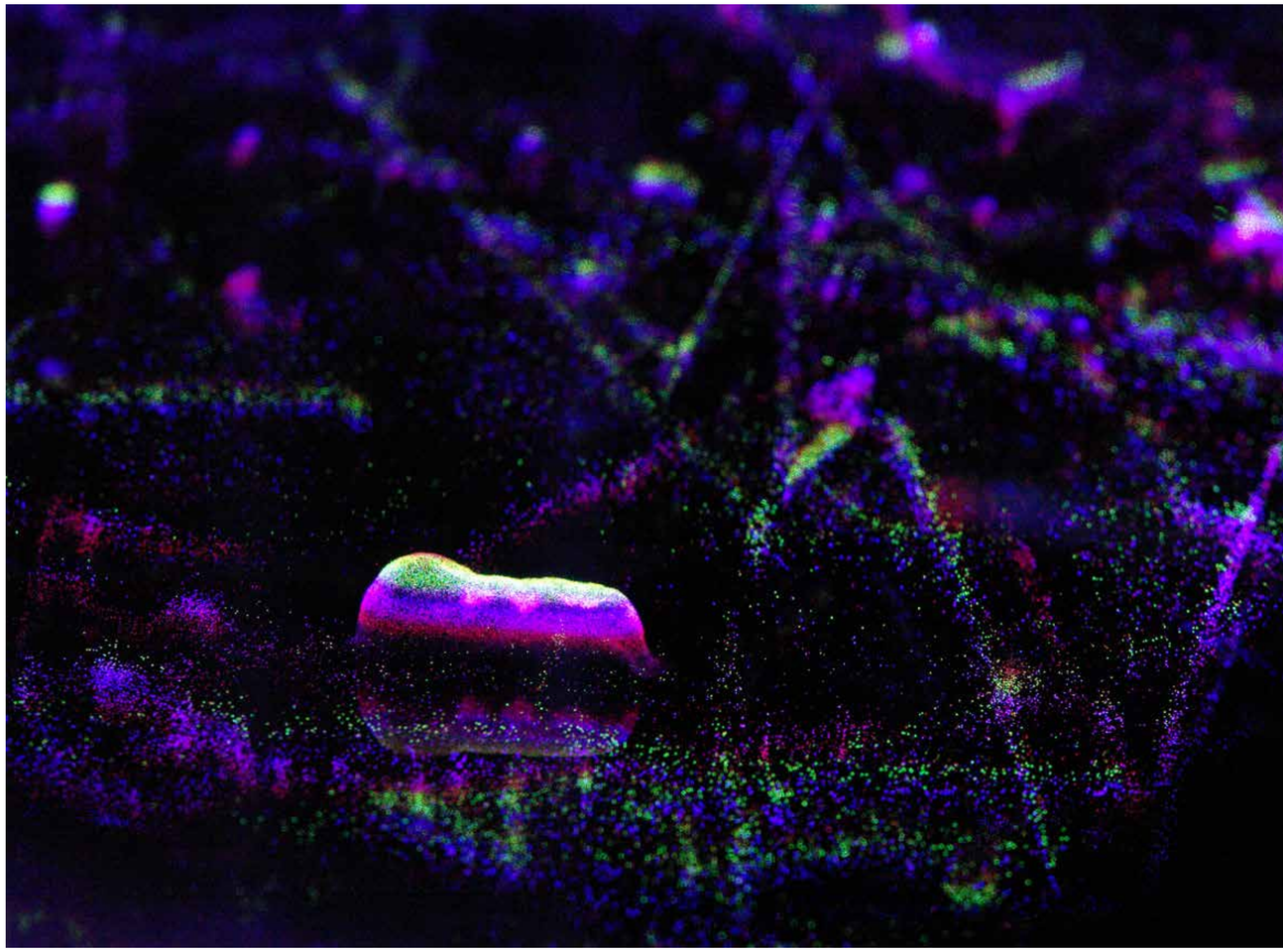
In *Memory Vapour* (2011), a cloud chamber combined with an electrostatic particle accelerator is illuminated by a scanning white laser sheet, transforming its cold gaseous contents into a dynamic prism. Ionised nuclei, muons, antiprotons, electrons and positrons are traced by trails of condensation droplets, each of which the laser transforms into a luminous micro-lens. Consequently, a unique means of iridescent depth perception emerges. Our observations are further enhanced by the rapid scanning of the laser sheet, which enables an expansion of the particle tracks' temporal resolution. Just as high-speed cinematography provides slow-motion insights into otherwise imperceivable mercurial events, the scanning laser sheet decelerates and unblurs cosmic ray trails for the naked eye. The viewer poignantly realises that the motionless appearance of "empty" space conceals an overflowing source of continuous energy.

A literally "universal" sense of fairness (both in terms of equality and beauty) underlies the ubiquitous cascade of cosmic rays. Arising incessantly under highly diverse and mostly ambiguous celestial circumstances, these omnidirectional emissions drench us in a scintillating subatomic sea that stretches all the way back to the early universe.

Upon their discovery at the beginning of the 20th century, there were vigorous disputes as to whether these ionisation trails were of earthly, solar or extra-solar origin, and whether they were triggered by charged particles or neutral photons. From underwater depths to high altitudes, from the poles to the equator, increasingly more sophisticated measurement expeditions traversed the globe. The experimenters almost always concluded that the rays entered their instruments in equal amounts from every possible angle.

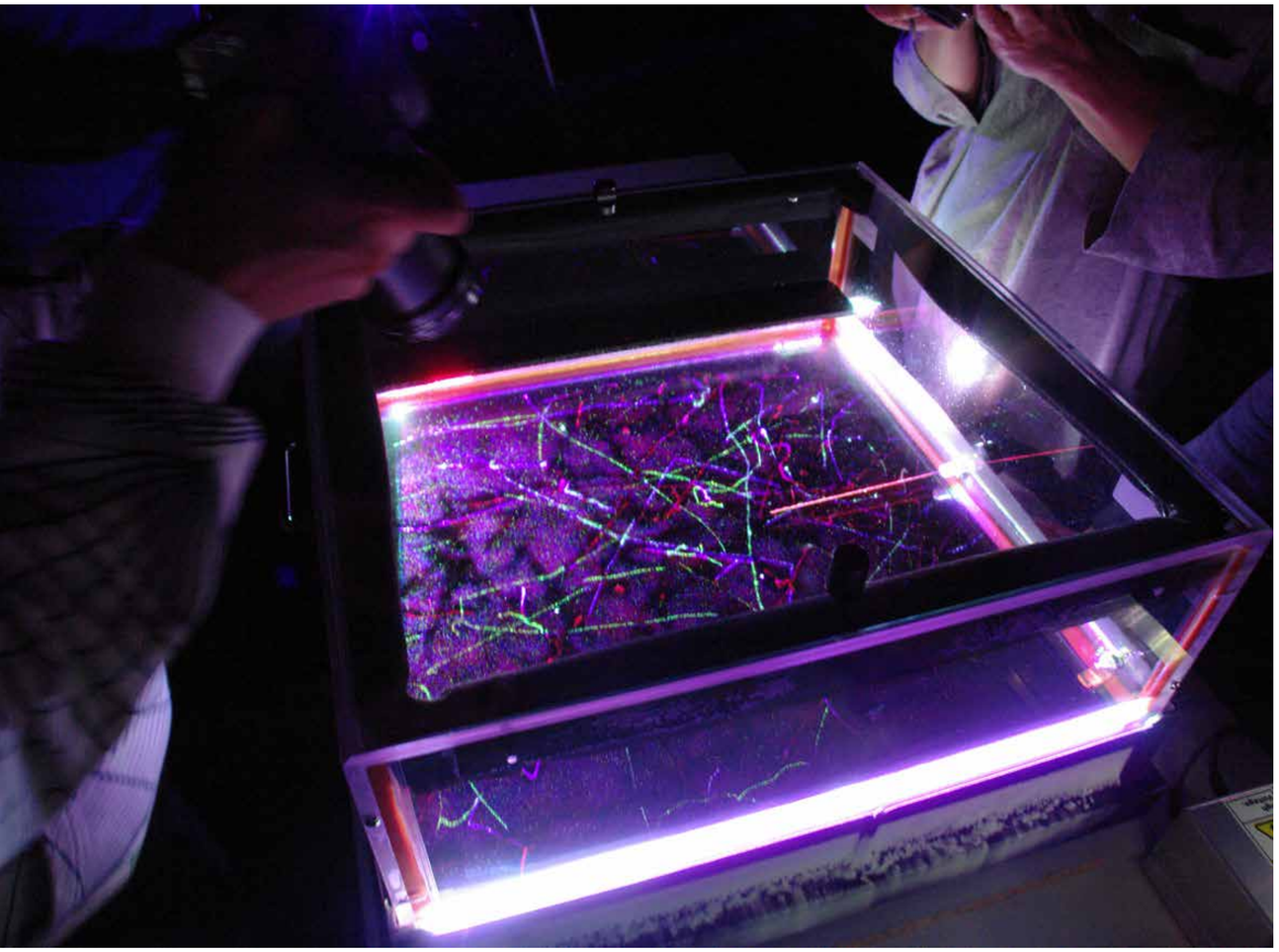
14

The motionless appearance of "empty" space conceals an overflowing source of continuous energy.



SCIENCE BEHIND

In 1925, Nobel laureate Robert Millikan definitively labelled these radioactive emissions cosmic rays. He perceived them as photonic "birth cries" of new atoms, contradicting the first as well as as the second law of thermodynamics. According to Millikan, it would be unjust for the universe to entropically dwindle into frigid equilibrium.



14

The experimenters almost always concluded that the rays entered their instruments in equal amounts from every possible angle.

BIOGRAPHY

Dmitry Gelfand *(b.1974, St. Petersburg, Russia) and* **Evelina Domnitch** *(b. 1972, Minsk, Belarus) create sensory immersion environments that merge physics, chemistry, and computer science with uncanny philosophical practices. Current findings, particularly regarding wave phenomena, are employed by the artists to investigate questions of perception and perpetuity. Such investigations are salient because the scientific picture of the world, which serves as the basis for contemporary thought, still cannot encompass the unrecordable workings of consciousness.*

Having dismissed the use of recording and fixative media, Domnitch and Gelfand's installations exist as ever-transforming phenomena offered for observation. Because these rarely seen phenomena take place directly in front of the observer without being intermediated, they often serve to vastly extend one's sensory threshold. The immediacy of this experience allows the observer to transcend the illusory distinction between scientific discovery and perceptual expansion.

In order to engage with such ephemeral processes, the duo has collaborated with numerous scientific research facilities, including the Drittes Physikalisches Institut *(Goettingen University, Germany), the Institute of Advanced Sciences and Technologies (Nagoya),* École Polytechnique *(Paris) and the European Space Agency. They are recipients of the Japan Media Arts Excellence Prize (2007), and five Ars Electronica Honorary Mentions (2007, 2009, 2011,2013, and 2017).*

ALAN ALPENFELT
IN COLLABORATION WITH PHILOSOPHER NICOLE DEWANDRE

Secret Sound Stories

P2

WHAT STORY DO YOU TELL?

RESONANCES

Cosmos without, infinity within. Our own stories are as rich as nature's and as vast as the universe. Each story of unfairness reflects on you, on me, on us, on every being, as precious as one bee, as alive as a single mouse, as deep as any thinker. Without these stories, fairness will never be complete. Fairness, given by nature and nurtured by humans, is the very soil from which democracy derives its nutrients, composed and decomposed from all stories. What story do you tell?

ALAN ALPENFELT
IN COLLABORATION WITH PHILOSOPHER NICOLE DEWANDRE

ART INSTALLATION

Reality is actually
made of invisible particles
and emptiness is
as concrete as
tangible matter.

[...]
Solo quest' iride posso
lasciarti a testimonianza
d'una fede che fu combattuta,
d'una speranza che bruciò più lenta
di un duro ceppo nel focolare
Conservane la cipria nello specchietto
quando spenta ogni lampada
la sardana si farà infernale
e un ombroso Lucifero scenderà su una prora
del Tamigi, dell' Hudson, della Senna
scuotendo l'ali di bitume semi-
mozze dalla fatica, a dirti: è l'ora.
[...]

Piccolo Testamento – Eugenio Montale

How can we save each other through what is most fragile? This is what Italo Calvino asked himself in his *American Lessons* by reading Eugenio Montale's poem *Piccolo Testamento*. He tried to understand how he could talk about his contemporary world without being drowned by the inevitable weight of its overwhelming tragedies. He analysed Lucrezio's *De rerum natura* which reminded the reader that reality is actually made of invisible particles and that emptiness is as concrete as tangible matter. He wanted to find the poetry of the invisible.

Fairness and unfairness can be translated respectively into what is seen and what is invisible. By conversing with philosopher Nicole Dewandre, V XX ZWEETZ analysed the concept of modernity. Somehow, as modernity has evolved, the societies in which we live have defined what exists only through what is perceived as visible. Or the other way around: we make visible what we want to make important. The rest, inevitably, disappears. Even worse, it is considered as never having existed.

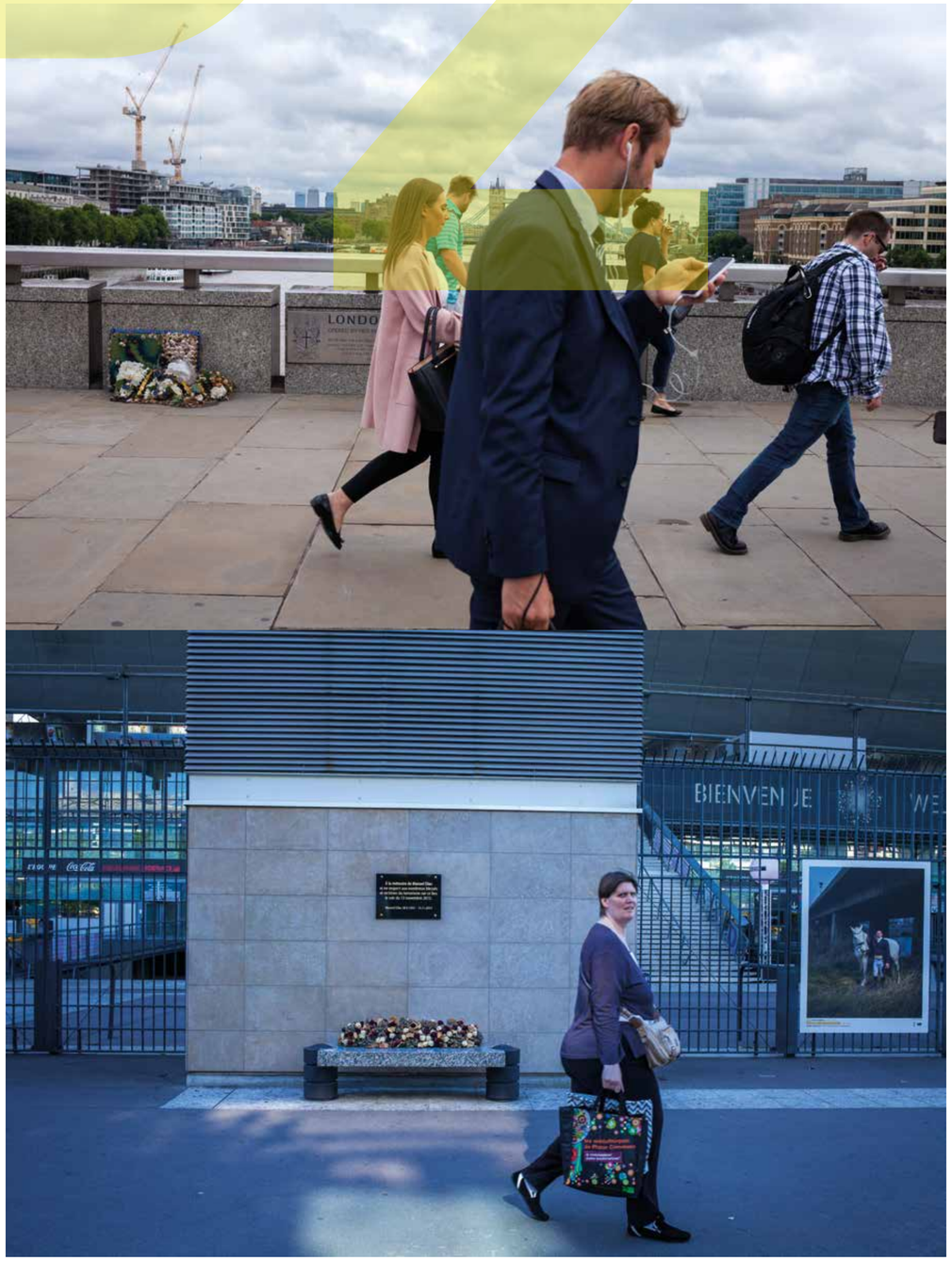
We decided therefore to shine a very fine and delicate light onto those undefined European stories which lie in our consciousness, but are forced into the dark.

Terror attacks and migration continue to influence our society since the fall of the New York Twin Towers, pushing fear into our homes and minds. But terror attacks are the effect of something very unfair in the political, social, and economic systems, which cause people to feel deceived and angry. And it seems we are not learning: actor/photographer Gabriele Ciavarra travelled to 13 different spots in Europe to document those places where terrorist attacks were carried out since the killing of Emperor Franz Ferdinand in 1914. To name a few: Piazza Fontana, Milan 1969, SwissAir Flight 330 in Würenlingen 1970, PanAm 103 1988 in Lockerbie, UK, Madrid Trains Attack 2004, London Bombings 2005, Utoya Killings 2011 Norway, Paris attacks 2015, Bruxelles attacks 2016, London attacks 2017.

We stage *Secret Sound Stories* by linking stories of these FEAR/(un)FAIR places with the artistic and scientific concerns of the Resonance Festival installations. More than a walking catalogue, *Secret Sound Stories* bridges the experience of the visitor to the intents of the conceivers with real-life anecdotes putting the issue of fairness squarely in the individual experience of [us] all.

It does this by being a one-to-one intimate and personal guided path in which the visitor listens to audio tales written by hidden actors, using wireless headphones. These stories are directly related to the different art works exhibited during the festival but are also part of a bigger picture: through the presentation of a series of photographs we give life to unique personalised tales that unveil to us details of realities which are often forgotten or excluded in our society. The listeners are guided through their secrets creating their personal visual sound map; an intimate, parallel secret world of which other visitors are unaware.

The idea is to empower the perception of Fairness each visitor has, by giving him or her a small secret to take away: a secret that will enhance understanding of how Science and Art are at work to improve our society in an equitable way.



ALAN ALPENFELT

IN COLLABORATION WITH PHILOSOPHER NICOLE DEWANDRE

SCIENCE BEHIND

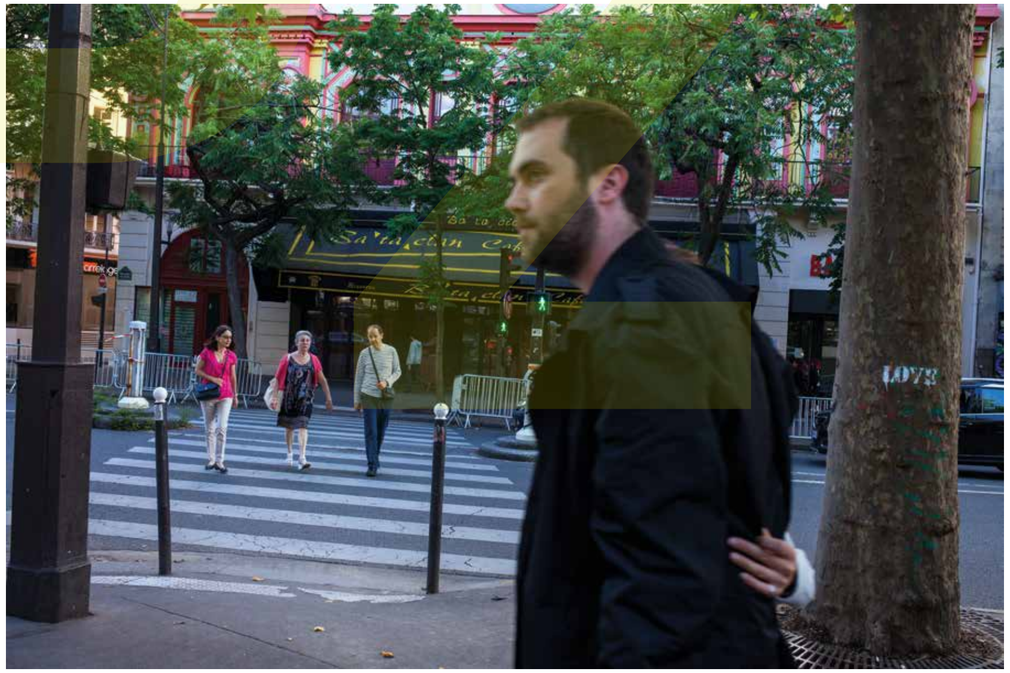
PHILOSOPHER NICOLE DEWANDRE

During the 2016 summer school, in order to identify the partnerships between scientists and artists, we were asked to do a "speed-dating" exercise. The artists were lined up on one side and the scientists facing them in another line. We had five minutes to introduce our respective projects, before moving to the next face-to-face. That was a challenging mode of operation! I must confess I thought this was a bad idea. I was wrong!

After 5 or 6 rotations, I came to face Alan and I resonated immediately with his form of expression. His "secret sound stories" setting, where actors are hidden and speak to spectators' ears in a personalised manner stroke me immediately as exploring wonderfully this strange and important frontier between interior and exterior, the self and the world. This is indeed a frontier that is most often overlooked in Modern terms, as we came to privilege observing things from an objective standpoint, i.e. overlooking this line between interior and exterior, this mental skin as it were.

This form of expression was a superb materialisation of a central feature of my philosophical research, which is to argue for the need to leave behind the rational subject as proxy for humanness and embrace the relational self, instead, grounded in Hannah Arendt's Human Condition. If politics is to be meaningful again, there is a need to acknowledge and foreground the relationality and vulnerability of human beings, on top of their rationality.

The conversations with Alan have shown that our Modern footprint is deep and pervasive that it is a huge challenge to shift conceptual frameworks. It is dangerous to leave behind what we have relied upon for 2 or 3 centuries, but it is a risk to take if we want to reconnect politics with reality and meaning. Furthermore, not doing it may lead to even more dramatic consequences.



BIOGRAPHY

Alan Alpenfelt *is the Swiss/British independent producer and director of V XX ZWEETZ, a Swiss crossmedia production company. The company delivers its projects through theatre, sound, radio, photography and documentaries. The main principle and focus of the company is to uphold awareness on social, historic, and existential issues.*
Alan's contemporary adaptation of Samuel Beckett's Words and Music *was selected for the Swiss Theatre Encounter 2016 in Geneva as one of the seven best Swiss productions of 2015. In 2016, he was part of the professional jury at the* 5th SonOhr Radio Drama Festival *in Bern.*
His site-specific project Secret Sound Stories *was selected at* Trasparenze Festival, *Modena, Italy and ALTO FEST in Naples, Italy, 2016. Among other work in 2017, he is directing live theatre performances of Friedrich Dürrenmatt radio dramas. He has been awarded an Artistic Residence which will begin in January 2018 at the LAC Theatre in Lugano, Switzerland.*
Alan has his own record label called Humankind Records which focuses on Sound Poetry.

Gabriele Ciavarra, *from Turin, Italy, is an actor and photographer passionate about journeys and stories.*
In 2005 he graduated from the Piccolo Teatro di Milano *Theatre School. Since then, he has been a dedicated participant in a wide range of national and international theatre projects. Concurrently, he has developed his passion for photographic storytelling. Since 2015, he has collaborated with Alan Alpenfelt and V XX ZWEETZ on the creation of different site-specific performances of* Secret Sound Stories.

Nicole Dewandre *studied applied physics engineering and economics at the Catholic University of Louvain (UCL, Belgium), operations research at the University of California (Berkeley) and philosophy at the Free University of Brussels (ULB, Belgium). She is the author of "Critique de la raison administrative. Pour une Europe ironiste", published at* Editions du Seuil *in Paris in 2002. (collection "l'Ordre Philosophique").*
Earlier in her career, she was advisor to the Director-General of the Information Society and Media Directorate General, European Commission, for the societal dimension of the Digital Single Market, the Commission's strategy to deliver social and economic benefits through ICT. Before that, she was Head of Unit in DG Research to promote gender equality in research, to foster the science and society dialogue and to enhance the alignment of EU-funded research with sustainable development goals.

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CREDITS

RESONANCES: SCIENCE – ART – SOCIETY
MILANO, SEPTEMBER/OCTOBER 2017
A FESTIVAL ORGANISED BY THE JOINT RESEARCH CENTRE OF THE EUROPEAN COMMISSION

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With the support of	Vladimir Sucha, Director General Delilah Al Khudhairy, Director Strategy and Work Programme Coordination Jutta Thielen-del Pozo, Head of Unit Scientific Development
Special Thanks to	Freddy Paul Grunert, Cristina Fiordimela

This exhibition would not have been possible without the professional help of the *Museo nazionale Scienza e Tecnologia*, Milan and the generosity of its team.

The Members of the SciArt Team and the Scientific Development Unit want to give a special thanks to their families for their support and understanding.

Je navigue, depuis trente ans, dans ces eaux. Elles sont à peu près désertes, oubliées, comme interdites.

Deux cultures se juxtaposent, deux groupes, deux collectivités parlent deux familles de langues. Ceux qui furent formés aux sciences dès leur enfance ont coutume d'exclure de leur pensée, de leur vie, de leurs actions communes, ce qui peut ressembler à l'histoire et aux arts, aux œuvres de langues, aux œuvres de temps. Instruits incultes, ils sont formés à oublier les hommes, leurs rapports, leurs douleurs, la mortalité. Ceux qui furent formés aux lettres dès leur enfance sont jetés dans ce qu'on est convenu de nommer les sciences humaines, où ils perdent à jamais le monde : œuvres sans arbre ni mer, sans nuage ni terre, sauf dans les rêves ou les dictionnaires. Cultivés ignorants, ils se consacrent aux chamailles sans objet, ils n'ont jamais connu que des enjeux, des fétiches ou des marchandises. Je crains que ces deux groupes ne se livrent combat que pour des possessions depuis longtemps raflées par un troisième, parasite, ignorant et inculte à la fois, qui les ordonne et qui les administre, qui jouit de leur division et qui la nourrit!

PASSAGE DU NORD-OUEST

I have been sailing these waters for thirty years. They are almost deserted, forgotten, as if forbidden.

Two cultures are juxtaposed, two groups, two communities speak two different languages. Those who were trained in science from their youth are accustomed to exclude from their thought, from their life, from their common actions what may resemble history and the arts, works of language, works of time. Uncultivated men of learning, they are trained to forget men, their relationships, their sorrows, their mortality. Those who were trained in literature from their youth are thrown into what we agreed to call the human sciences, where they lose the world forever: works without trees or sea, without cloud or earth, except in dreams or dictionaries. Cultivated ignoramuses, they devote themselves to the squabbles without object, they have never known but stakes, fetishes or merchandise. I am afraid that these two groups are fighting for possessions long since swept away by a third, a parasite, ignorant and uncultivated at the same time, who gives them orders and who administers them, who enjoys their division and nourishes it!

Michel Serres, Hermes V - Le passage du nord-ouest, Paris, 1980, p. 17 (own translation)

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Distribution
Publications Office of the European Union, Luxembourg

This catalogue has been prepared as a collaborative effort between JRC scientists and external artists. It is part of the Resonances Festival and Exhibition that takes place from 13-15 September at the JRC in Ispra, Italy, and from 21 September to 22 October in the *Museo Nazionale della Scienza e della Tecnologia "Leonardo da Vinci"* in Milan, Italy.

JRC 107774
EUR 28727EN
ISSN 1018-5593 (print)
ISSN 1831-9424 (online)
ISBN 978-92-79-71773-4 (print)
ISBN 978-92-79-71774-1 (online)
ISBN 978-92-79-71772-7 (CD-ROM)
Catalogue Number KJ-NA-28727-EN-C (print)
Catalogue Number KJ-NA-28727-EN-N (online)
Catalogue Number KJ-NA-28727-EN-Z (CD-ROM)
doi: 10.2760/40847 (print)
doi: 10.2760/349409 (online)
doi: 10.2760/042121 (CD-ROM)

Can artists collaborate with scientists and policymakers? That is the question the European Commission's Science and Knowledge Service, the Joint Research Centre or JRC, put itself. The JRC wanted to understand if the rapprochement between art and science of the last decades could help it to adapt to changing times, to refine its policies and reach out to the public.

To discuss and experiment, the JRC proposed the theme of Fairness. Fairness is an odd phenomenon, most visible when it is absent or negated. Yet too many of the European Citizens consider that our society is not fair enough. Fairness is also a complex subject of which too little is known, making it a rich territory for artists upon which to experiment, together with the scientists and policymakers.

The result is an exhibition of 16 works of art presented in the Resonances II exhibition at the Milan National Science Museum for Science and Technology in September and October 2017. Freely arising from the discussions, these works attempt to place fairness in the context of society and nature, of economy, science and the cosmos. They treat a host of subjects, from dying olive trees in Apulia to the language of the market, from the promises of transhumanism to our collective hyper-connectivity, from air pollution to dying bees.

These art works are an invitation to all members of the public to reflect on these subjects and the great theme of Fairness, together with scientists and policymakers. A small step towards a new world, that, we hope, will be braver than the current one in responding to the challenges we face.

doi: 10.2760/349409
ISBN 978-92-79-71774-1