



#105

AUGUST/SEPTEMBER 2021

# Research<sup>★</sup>eu

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towards greener power devices

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Improved seasonal forecasts  
to optimise crop management

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Community-based policing  
critical to post-conflict countries

**SPECIAL FEATURE**  
**FROM SOCRATES TO MODERN**  
**SCIENCE: NEW PERSPECTIVES**  
**IN EUROPEAN PHILOSOPHY**

# Editorial

Posing the big questions through our special feature focus on philosophy, exploring how social media and crowdsourcing can help in a crisis and a transatlantic initiative to develop cutting-edge solar panels

## Welcome to this month's Research\*eu magazine

Probably like many of our regular readers, your editor's first real brush with philosophy came at university, when he had to take a compulsory course in his first year of undergraduate studies on political philosophy, galloping all the way from Socrates to John Rawls in the space of one academic year. To his immense surprise, he loved this course to the point that he willingly undertook two voluntary advanced courses in political and moral philosophy later in his undergraduate and graduate studies. Now, over a decade later, he lives with, and is shortly due to marry, an actual real philosopher.

So, philosophy remains a major aspect of your editor's everyday life (admittedly, sometimes grudgingly so) but he's willing to bet the farm that this is not the case for the majority of our Research\*eu readers... or so they think. Philosophy is actually always operating behind the curtain of our everyday lives, leaving its footprint on our discussions, internal monologues and decisions on how we choose to lead our lives and what we perceive to be right, just and meaningful. Most of the time, we don't even realise that we're engaging with philosophical ideas and concepts (again, your editor being an exception, as his partner is constantly 'philosophising' him, especially during disagreements).

Whilst it's often the case that philosophy conjures up the image of old bearded Greek men living thousands of years ago, the ideas and arguments they put forward then are just as relevant to our modern lives now. We rely on science to advance our technological capabilities and help us to understand the universe better, and science is indeed going to be vital in our struggle against major modern-day challenges such as climate change, but science can't definitively provide the answers on what makes a good life or what

makes a life worth living. It can tell us how our bodies work but it can't tell us what it truly means to be a human being. This is philosophy's turf. One is not superior to the other, both are required equally to push the boundaries of human knowledge and understanding (and of course, the philosopher will immediately jump in and quip: "What is knowledge actually?"). In this issue's special feature, we highlight seven talented researchers working within the realm of philosophy and we hope they leave our readers with some food for thought!

Elsewhere in this issue, we highlight the first-year successes of the **LINKS** project in our regular **Project of the Month** feature. LINKS is investigating both the opportunities and challenges of social media and crowdsourcing during major emergencies and how they can be better utilised in disaster management. Then, in **Life After**, we reinterview a very talented young researcher who is continuing to advance cutting-edge solar panel technology following his Marie Skłodowska-Curie Actions project, **Crystal Tandem Solar**.

And last but not least, we present our usual **EU Agenda** of upcoming events, online and otherwise, and if you haven't already, this is just another reminder to our readers to check out our dedicated podcast, **CORDIScovery** – with several episodes now in the bag, we're confident there's at least one episode that will pique the interest of all of our readers. Download or stream from all of the major podcast platforms!

As always, if you have any queries, questions or suggestions (but hopefully never a complaint), please feel free to drop us a line at [editorial@cordis.europa.eu](mailto:editorial@cordis.europa.eu).

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### Corrigendum to Research\*eu #104 (July 2021)

In our special feature on solar system exploration, we wrote that Titan is one of the moons of Jupiter. It is in fact, a moon of Saturn. Sorry about that.

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# State-of-the-art technology solutions to empower stroke patients

*Health and social care services lack personnel or finances to deliver the required amounts of therapy to stroke patients at home. Innovative methods are needed to bridge the gap in care involving the recovery of stroke patients in Europe.*

Community health and social care (H&SC) services need assistance so that patients can sufficiently recover after suffering a stroke. By working in novel ways and reengineering care delivery systems with new innovative technology and solutions, we can think differently about our approach to care and improve the well-being for patients across Europe while optimising the opportunity for post-stroke recovery.

## TRANSFORMING HEALTH AND SOCIAL CARE SERVICES DELIVERY

The contribution of a patient's informal caregiver, family and social network is significant. However, it remains a challenge to support the role of this type of caregiver. Despite the progress made in the development of technologies to assist patients, no system is available on the market to improve rehabilitation at home. What's more,

no existing solutions are integrated with H&SC services. As a result, public procurers can't use open tenders to implement effective technology in solving system failures.

"A tool that can be safely applied at home to help patients practise their motor skills at sustainable costs represents added value for the health system for both patients and clinical staff," says Rachael McKibbin, head of the Small Business Research Initiative at the Business Services Organisation, responsible for coordinating the EU-funded MAGIC (Mobile Assistance for Groups Individuals within the Community – STROKE REHABILITATION) project.

MAGIC recognised pre-commercial procurement (PCP) as the most viable option in encouraging the market to address these shortcomings by developing cutting-edge products. To support the rehabilitation of post-stroke patients, project partners used PCP to identify



“ *A tool that can be safely applied at home to help patients practise their motor skills at sustainable costs represents added value for the health system for both patients and clinical staff.* ”

new technologies and services. They established and executed a competitive PCP process to run a cross-border call for tender.

### **PUSHING THE TECHNOLOGY BOUNDARIES FOR STROKE SURVIVORS**

As part of the PCP competition, suppliers developed and tested their solutions in Italy and Northern Ireland. One solution involved incorporating virtual reality computer games into a stroke rehabilitation system to improve patients' current stroke rehabilitation pathways. Another concerned a novel medical device to rehabilitate stroke patients at home by using wearable sensors and biofeedback for total body exercises and smart objects for hand and arm rehabilitation. The final solution was a machine learning-based wireless platform designed to operate in patients' homes. It addresses their specific rehabilitation needs by enabling therapists to personalise routines, providing continuous monitoring and feedback on performance.

This generic procedure carried out by the MAGIC team will form the basis for future national PCP calls. Public organisations throughout the EU will become familiar with the PCP process and tools, and exploit them to accommodate their own needs. Ultimately, the goal is to employ PCP in finding solutions to common healthcare problems through innovative technology development.

Clinical trials demonstrated the feasibility of the technological solutions. Positive feedback was received from both patients and clinicians.

Thanks to MAGIC's proposed solutions, patients can recuperate at home by benefiting from a range of exercises and activities purposely developed for them. H&SC staff will be able to record and assess training data for each patient and further adapt the activity difficulty.

#### **MAGIC**

- Coordinated by the Regional Business Services Organisation in the United Kingdom
- Funded under Horizon 2020-HEALTH
- [cordis.europa.eu/project/id/687228](https://cordis.europa.eu/project/id/687228)
- Project website: [magic-pcp.eu](https://magic-pcp.eu)

#### **HEALTH**

# Digital tools help improve young people's mental health

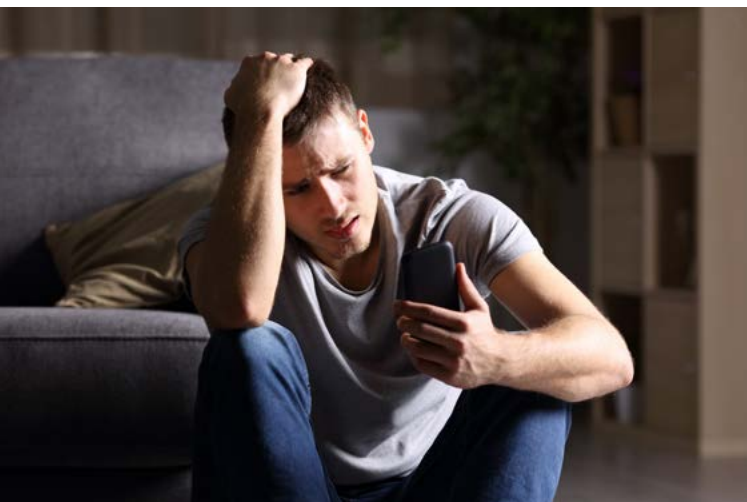
*Despite being uniquely vulnerable to mental health disorders, young people are often underserved by support services. TEAM developed a range of accessible co-created digital tools to meet this need.*

Most mental disorders begin in youth, with research showing that 50 % emerge by age 14 and 75 % before 24. Despite consensus that early intervention saves lives and reduces the need for longer-term adulthood interventions, treatment options remain limited for young people.

To help increase access to mental health services, the EU-supported TEAM (Technology Enabled Adolescent Mental Health) project developed innovative technological solutions.

“We drew on expertise beyond traditional disciplines like psychology, to design integrated technology for the assessment, prevention and treatment of mental health problems,” says project coordinator David Coyle from University College Dublin, the project host.

TEAM consisted of 15 individual projects, each supervised by experts from multiple disciplines. The project's early stage researchers received interdisciplinary training in



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topics such as human computer interaction, social and emotional skills, mental health theories and practice, as well as with hands-on activities such as a ‘designathon’.

## DIAGNOSIS, ASSESSMENT AND TREATMENT SOLUTIONS

The project, backed by the Marie Skłodowska-Curie Actions, initially conducted an online survey of 1308 young people, in collaboration with national mental health charity ReachOut Ireland, to determine how help is typically first sought online.

The survey results led to detailed guidelines and a theoretical foundation for the design of support tools.

“Seeking help is a key first step in addressing mental health difficulties. If we can improve this experience, that will have a significant impact,” notes Coyle.

TEAM developed a range of technologies to support early and rapid ongoing assessment of mental health difficulties. This included a smartphone tool to help young people aged 15-25 with bipolar disorders to monitor their mood, activity and sleep. TEAM also created two online tools for cognitive assessment – one for home use, the other for mobile devices.

As for prevention, TEAM co-designed technologies with adult stakeholders and some young people, to help youth build resilience and care for their own mental health better. These included apps suitable for school settings, and also a design framework for technology to support particularly vulnerable populations such as unaccompanied migrant youth and young people with acquired brain injuries.

“ We drew on expertise beyond traditional disciplines like psychology, to design integrated technology for the assessment, prevention and treatment of mental health problems. ”

Regarding treatment, TEAM developed an offline toolkit for the rapid creation of therapeutic games, alongside a prototype app that allows young people at risk of self-destructive behaviour to formulate their own personalised short-term and long-term coping strategies. A cognitive behavioural therapy (CBT) game, Pesky gNATs, was also rolled out through Ireland’s Health Services Executive.

Additionally, the project used a computational model to match personality traits to beneficial daily activities which were then recommended through a Telefónica mental health application.

## MENTAL HEALTH POLICY

The 2017 Global Burden of Disease Study estimated that depression affects 264 million people globally. Another study published in The Lancet found that: “Neuropsychiatric conditions are the leading causes of disability worldwide, accounting for 37% of all healthy life years lost from disease.”

Moreover, it is known that poor mental health in young people is often associated with other problems, notably lower educational achievement, substance abuse and violence.

**Depression**  
affects more than  
**264 million** people globally



In addition to their tools, TEAM developed an ethics and governance framework for human computer interaction design, providing guidance on considerations such as how to ensure privacy in the design of such tools.

Currently, each of TEAM's partners remains actively involved in research on technology-enabled mental health, continuing to collaborate to further exploit the technology and theories developed during the project.

## TEAM

- Coordinated by University College Dublin in Ireland
- Funded under Horizon 2020-MSCA-ITN
- [cordis.europa.eu/project/id/722561](https://cordis.europa.eu/project/id/722561)

## HEALTH

# By easing insomnia, emotional support apps also prevent depression

*When it comes to depression, prevention is better than cure. The challenge is in first identifying those most at risk, with researchers targeting insomnia as a modifiable risk factor.*

A challenge when quantifying mental health is that disorders often straddle multiple diagnoses. Insomnia has been identified as the second most common mental

disorder in the EU, ranked between anxiety disorders and major depression. That study also found that less than



“*The findings have already laid the groundwork for a more extensive array of innovative interventions to enhance overnight emotion regulation.*”

one third of cases received treatment, suggesting a significant level of unmet need.

Insomnia presents a primary epidemiological risk factor for other mental health problems. The odds of developing depression are doubled among those with sleep issues. Yet, the underlying mechanisms remain understudied.

“Fortunately, not everyone with insomnia develops other mental health problems. By detecting the differences between those who do and those who don’t, we can identify those most at risk and prioritise them for preventive treatments,” explains Eus J. W. van Someren of the Netherlands Institute of Neuroscience and project coordinator of the INSOMNIA (Insomnia’s Negative Sequelae On Mood: from Neuroscience to Intervention in the Aged) project.

## COMPARING RESTLESS SLEEPERS

The project started by using big data assessed through sleepregistry.org an online citizen science platform to improve our understanding of insomnia. Profiles of insomniacs with an increased lifetime risk of depression were identified using latent class analysis.

The team is now comparing high- and low-risk insomniacs on multiple measures of brain structure and function to identify underlying factors. Focusing on high-risk insomniacs, the team is also working to determine whether these combined measures could predict who would be most likely to develop depressive symptoms within a year.

They expect to have results this autumn, but preliminary findings point to the involvement of the emotion regulation circuits of the brain rather than the sleep-regulating systems, as would be expected. If confirmed, this finding promises to finally reveal why insomnia is the primary risk factor for developing depression and other mental health problems, notably anxiety disorders and post-traumatic stress disorder.

## PREVENTIVE MEASURES

The INSOMNIA project also evaluated whether internet-supported home insomnia interventions were able to improve sleep and prevent depression. These were guided by trained psychologists and included several cognitive, behavioural and light exposure modules.

“This approach greatly increased compliance compared to automated digital interventions. The combination of several online modules was found to be especially effective in preventing depressive symptoms in the 132 participants, at least for a year,” adds van Someren.

Being able to identify people with a high risk of depression and prioritise them for preventive interventions benefits not only the individuals concerned, but also stretched mental health services. As well as developing a pioneering methodology for finding those vulnerable members of society, INSOMNIA’s preventive internet-based intervention can be scaled up for large populations.

“While we are still scrutinising the data for further insights, which could change perspectives on how we best support mental health, the findings so far have already laid the groundwork for a more extensive array of innovative interventions to enhance overnight emotion regulation,” says van Someren.

## INSOMNIA

- Hosted by the Royal Netherlands Academy of Arts and Sciences in the Netherlands
- Funded under Horizon 2020-ERC
- [cordis.europa.eu/project/id/671084](https://cordis.europa.eu/project/id/671084)
- Project website: [bit.ly/34ovc3t](https://bit.ly/34ovc3t)





SOCIETY

# A closer look at understanding and improving the behaviour of leaders

*Effective and ethical leadership becomes even more relevant in a global pandemic, during which human life seems to be directly weighted against economic disaster. To find solutions, leadership on all levels of society must be involved.*

Effective, ethical and value-oriented leadership are fundamental to societal success in a multitude of contexts, be it in the corporate world, the military or politics. Skilful leadership can reduce conflict, unite followers, and see societies and organisations flourish. Negative forms of leadership can have devastating consequences.

The EU-funded project LEADERPROFILE (Assessing positive and destructive leadership on multiple dimensions: How to better understand and improve the behaviour of the people who lead us) provided a comprehensive overview of the current status quo of research on negative forms of leadership and their antecedents and consequences.

Undertaken with the support of the Marie Skłodowska-Curie Actions programme, the project took a first step towards the laboratory-based experimental study of leadership, which in the long run will provide crucial pieces of evidence for working on effective and sustainable interventions to support leaders in their daily jobs.

## EXAMINING LEADERSHIP BEHAVIOUR IN LABORATORY SETTINGS

“Now more than ever, we need to foster inclusive, innovative and reflective societies. Our societies, however, can only be as reflective as their leaders,” says Franziska Emmerling,

“Now more than ever, we need to foster inclusive, innovative and reflective societies. Our societies, however, can only be as reflective as their leaders.”

head of the Neurophysiological Leadership Lab at the Technical University of Munich and LEADERPROFILE coordinator. Claudia Peus, professor of Research and Science Management also at the University and LEADERPROFILE project supervisor, adds: “European leaders are under considerable strain, considering fast changes rooted in globalisation, migration, the economic crisis and digitalisation.”

In this context, leaders need support in developing sound self-reflection skills. To be effective and sustainable, any endeavour to support leaders has to be rooted in sound scientific evidence.

Emmerling suggests that future leadership research “needs to implement a multi-methodological approach reaching beyond questionnaire-based studies and include experimental laboratory studies.” The main focus of LEADERPROFILE was, thus, to develop experimental set-ups in which to study leadership.

Leadership is not only based on a leader’s actions but emerges (as effective or ineffective) from followers’ perceptions of and reactions to these actions. LEADERPROFILE investigated how the perception of a leader is formed and how various leadership behaviours affect this perception. To do this, it followed an experimental approach and addressed cognitive and psychophysiological aspects on the part of followers. A series of studies identified implicit and explicit cognition

as significant factors affecting followers’ perceptions of leader effectiveness.

## NOVEL TECHNOLOGIES FOR LEADERSHIP RESEARCH

To further extend the classic experimental research approach, the team included novel technologies, namely social robotics, into their laboratory studies of leadership. “Recent technological advancements have put social robotics on the map of researchers. Their increasing social capabilities and functions have created amplified potential for use in highly complex domains,” notes Emmerling. As research shows that humans can trust and cooperate with robots, LEADERPROFILE investigated how followers perceive and react to robot leaders showing various leadership styles.

Destructive leadership has direct, global and long-lasting effects on societal success and – more importantly in times of a global pandemic on human life. “We need to support our leaders by putting them on our scientific map and developing evidence-based models on how to optimally lead in times of crisis and beyond – models which have to consider self-reflection and sound ethics,” concludes Emmerling.

### LEADERPROFILE

- Coordinated by the Technical University of Munich in Germany
- Funded under Horizon 2020-MSCA-IF
- [cordis.europa.eu/project/id/798638](https://cordis.europa.eu/project/id/798638)
- Project website: [bit.ly/LEADERPROFILE](https://bit.ly/LEADERPROFILE)

### SOCIETY

# Shaking hands with the authors of the Bible

*A novel project used artificial intelligence to analyse the handwriting of the Dead Sea Scrolls, revealing new information about the scribes who recorded the foundations of Judaism and Christianity.*

The Dead Sea Scrolls are a set of Jewish religious texts dating from the 3rd century BCE to the 2nd century CE. Discovered in the Qumran Caves on the shores of the

Dead Sea in the 1940s and 1950s, they provide the earliest recorded examples of the Hebrew Bible, before and during the emergence of Christianity.

The EU-funded HandsandBible (The Hands that Wrote the Bible: Digital Palaeography and Scribal Culture of the Dead Sea Scrolls) project is an interdisciplinary effort that brings together the sciences and the humanities to shed light on the manuscripts' authors. "We want to understand who wrote the Bible, and how they went about it," explains project coordinator Mladen Popović. "We want to figuratively shake hands with these ancient scribes."

## HANDWRITING SAMPLES

Contrary to what is usual in the field, Popović decided on using the physical evidence of the manuscripts and, more precisely, the handwriting on the manuscripts as a new entry point to answer such questions.

The Israel Antiquities Authority provided the HandsandBible project with new, multispectral images of the scrolls, which Popović and his team examined for the scrolls' ancient handwriting – palaeography – with purpose-built artificial intelligence (AI) software at the University of Groningen.

"With high-resolution images, the algorithm can measure all sorts of dimensions, and extract from the ancient ink traces, which are the result of muscle movements of those ancient scribes, the idiosyncrasies of handwriting of individual scribes," says Popović.

Although Popović admits that we will never know the exact names of the scribes, the technique can be used to group the scrolls for particular writers.

## CHARACTER TRAITS

The project has unlocked new information on the manuscripts: one, known as the Great Isaiah Scroll, is now believed to have been written by two different authors. By comparing the composition of individual characters, such as 5011 incidences of the letter alef (א), the software uncovered an extremely subtle but consistent change in the handwriting halfway through.

This shows not only that scribes collaborated on copying biblical scrolls, but also that there was a high degree of professionalism in their mimetic ability to mirror another's scribe style of handwriting. The findings have been accepted for publication and are available as a preprint on the arXiv website.

The AI was also able to chart stylistic changes over time, allowing the project to put some of the documents into



chronological order. "This was difficult to create; it was very exciting to see if we could pull it off," adds Popović. "Now we see evidence that we have."

In an extremely rare move, the project was given physical samples from the Dead Sea Scrolls by the Israel Antiquities Authority for carbon dating. Although this was already done in the 1990s, techniques have improved considerably since then, especially regarding cleaning the samples.

This proved extremely difficult, says Popović, as the scrolls were treated with castor oil in the 1950s in an effort to make them more legible. A painstaking cleaning process was carried out by laboratories in Denmark, Italy and the Netherlands to remove this contamination prior to carbon dating. The results are still pending.

Popović also hopes they might be able in the future to identify where individual scribes lived: "It's a bit crazy, people say you'll never know, but if you push you can tap into new data and open up history in a way you haven't been able to before."

## HANDSANDBIBLE

- Hosted by the University of Groningen in the Netherlands
- Funded under Horizon 2020-ERC
- [cordis.europa.eu/project/id/640497](https://cordis.europa.eu/project/id/640497)



# More juice, fewer emissions: towards greener power devices

*A new material for power electronic devices could help cut carbon emissions by 6 million tons per year.*

Power electronics are behind many of the key innovations which will be crucial for Europe's green transition. Used to convert electricity, 'green' applications of power electronic devices range from electric cars to solar power systems.

The design of new materials plays an important role in making these devices more efficient and sustainable. The semiconductor cubic silicon carbide (3C-SiC) has emerged as a candidate with high potential for improving power efficiency for devices operating at voltages between 100 and 1200 V. The EU-funded project CHALLENGE (3C-SiC Hetero-epitaxiALLY grown on silicon compliancE substrates and 3C-SiC substrates for sustaiNable wide-band-Gap powEr devices) has now taken decisive steps towards turning it into a marketable technology.

"We have developed a new technology for the creation of large 3C-SiC wafers which can be further developed in the future to realise a commercial material for power devices," explains Francesco La Via, research director at the Institute for Microelectronics and Microsystems of the Italian National Research Council, which hosted the project.

## BETTER PERFORMANCE

The wafers are grown using heteroepitaxy, a process by which one kind of crystal is grown on the surface of another kind – in this case, on silicon substrates. The project team studied techniques for growing the material and gained a better understanding of why defects occur in its crystalline structure, and how these affect performance. They were



able to overcome a number of technological barriers that previously held back 3C-SiC growth on a larger scale to reduce the number of defects, considerably increasing the materials' performance and reliability.

By developing a process for reducing thermal stress, CHALLENGE succeeded in growing thick 3C-SiC layers of up to 300 microns. "This material has never been grown at these thicknesses before, because the large thermal stress resulted in breakage," La Via says.

## GREEN APPLICATIONS

A key added value of the new process lies in the combination of low production cost and high energy efficiency. The main applications of the technology developed under the CHALLENGE project are electric vehicles and solar inverters, which convert the output of solar panels into current that can be fed into the grid. "In both application fields, the adoption of 3C-SiC technology will result in a large reduction of power dissipation, involving considerable environmental benefits," La Via notes. Electric cars would also see their autonomy improved, as the technology could increase the distance they will travel with the same charge.

In the case of large-scale deployment, the impact on climate change mitigation efforts could be huge, La Via

“A reduction in carbon dioxide emissions by up to 6 million tons per year could be achieved.”

says: "With the introduction of 3C-SiC in the power device market, a reduction in carbon dioxide emissions by up to 6 million tons per year could be achieved."

Effectively bringing the technology to the market will require additional research efforts. According to La Via, these should aim to further improve the quality of the material on a number of levels including defect density and stress, and to improve our understanding of the requirements for building efficient devices. The team involved in the CHALLENGE project is currently working on several follow-up initiatives to turn the project's results into tangible progress.

## CHALLENGE

- Coordinated by the National Research Council in Italy
- Funded under Horizon 2020-LEIT-ADVMAT
- [cordis.europa.eu/project/id/720827](https://cordis.europa.eu/project/id/720827)
- Project website: [h2020challenge.eu](https://h2020challenge.eu)
- ▶ [bit.ly/CHALLENGE-VIDEO](https://bit.ly/CHALLENGE-VIDEO)

## ENERGY

# Game-changing biomass combustion technology

*An EU-funded project has helped bring to EU markets a disruptive furnace that can aid energy plants in reducing their environmental footprint.*

Biomass for energy (bioenergy) is the main source of renewable energy in the EU, with the heating and cooling sector the largest end user. Bioenergy plays a pivotal role in meeting the EU's climate targets under the European Green Deal that includes, amongst others, a reduction in greenhouse gas emissions and an increase in the share of renewable energy. However, many of today's technologies used in energy plants are unable to meet the EU's target

for lower emissions without the aid of costly emission reduction systems added to their solutions.

The technology of Dall Energy, a company that creates and implements innovative solutions for biomass-based energy plants, meets the demand for lower emissions. The EU-funded DEBS (Significantly cheaper and cleaner energy from biomass combustion) project set out to

validate and upscale one of their technologies, a biomass furnace that can outperform prominent grate combustion technology in the industry. “Additionally, we aimed to develop a name in the French energy market and other EU markets,” notes Jens Dall Bentzen, project coordinator.

## REVOLUTIONARY TECHNOLOGY LAUNCHED INTO THE ENERGY MARKET

The patented Dall Energy biomass furnace combines updraft gasification with gas combustion. “It reduces dust and particle emissions by more than 90% and can easily meet EU emission demands,” explains Bentzen. In addition, the furnace offers several benefits, including a reduction of about 50% in maintenance costs, 30% lower investment requirements due to its design, and a reduction of up to 40% in fuel costs. The technology is very fuel flexible, enabling the conversion of a wide range of low-value fuels in the same furnace.

“Through the project, we have achieved validation and upscaling of the furnace to a larger size. We have also become well known in the French market and are now offering our technology to major energy companies in France,” says Bentzen. Dalkia, which is part of the EDF group, a French multinational electric utility company, is an example. It currently operates hundreds of energy plants in France and has been tasked with expanding the district heating network in the city of Rouen.

To do this, it will install a new heating plant based on Dall Energy gasification technology to comply with the

“Through the project, we have achieved validation and upscaling of the furnace to a larger size. We have also become well known in the French market and are now offering our technology to major energy companies in France.”

city’s requirement for reducing its environmental footprint. “Additionally, we are now well known in other markets, having discussions with energy companies such as EON and ABB,” adds Bentzen.

## LOOKING TOWARDS THE FUTURE

There are about 4 000 biomass energy plants in the EU that can enjoy the benefits that this furnace brings. The furnace can also help the EU meet its 2050 climate goals to reduce greenhouse gas emissions by 80 to 95% below 1990 levels and secure a competitive and decarbonised energy system.

Discussing what may come next, Bentzen explains: “In the short term, in a year’s time, our focus will be on the Danish and French markets. In the longer term, we aim to be the biggest supplier of biomass plants in Europe. We are moving forward and partnering with large energy companies. Currently, we are making a collaboration agreement with ABB. I have also hired a new sales manager to help us with our expansion into Europe.”

## DEBS

- Coordinated by Dall Energy in Denmark
- Funded under Horizon 2020-Societal Challenges, Horizon 2020-SME and Horizon 2020-LEIT
- [cordis.europa.eu/project/id/811529](https://cordis.europa.eu/project/id/811529)
- Project website: [bit.ly/3uzHl0i](https://bit.ly/3uzHl0i)
- ▶ [bit.ly/debs-video](https://bit.ly/debs-video)



# Superconducting fault current limiter protects national electricity grids

*At home, in the event of short circuits, fuses cut power and prevent damage. Electricity grids, being much more complicated and powerful, have lacked fuses, until now.*



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Continental Europe has four large electrical grids. These criss-cross the landscape via heavy-duty wires carrying up to 380 000 volts. If two such cables ever touch, such as when a tree falls over the line, this causes a fault current, colloquially known as a short circuit. This will spark. The spark voltage can be enough to damage or destroy even equipment designed for high voltages.

In a domestic circuit, a fuse can prevent damage by instantaneously cutting off the power. Yet, at the extreme voltages of national grids, these devices cannot be used. To date, no practical equivalent has existed; if it did, it would be called a fault current limiter. Today, engineers achieve the same result of limiting (switching off) the fault current by various passive and non-ideal means.

In 2014, the Nexans company installed an experimental superconducting fault current limiter (SFCL) into the grid near the German city of Essen. Although that SFCL has effectively protected city power lines, the device was too expensive for commercialisation.

## IMPROVING THE SFCL

The EU-funded FASTGRID (Cost effective FCL using advanced superconducting tapes for future HVDC grids) project developed a lower-cost improvement on the initial SFCL. Specifically, FASTGRID uses the superconducting material optimally to reduce costs.

Superconductivity is the principle whereby certain materials exhibit zero electrical resistance. However,

“Our advanced superconducting conductor makes the superconducting fault current limiter much more attractive from an economic point of view.”

this only works while the material remains at cryogenic temperatures. For an electrical grid system equipped with the FASTGRID SFCL, in the event of a short circuit, the current rises sharply, by a given and known value, then the SFCL cuts in. The temperature of the superconducting element (tape-like wires made from the new superconducting material) then rapidly rises. So the material loses its superconductivity and resists electrical current. This limits the current to a safe level, preventing damage and making it easy for a switchgear (circuit breaker) to cut power quickly. The conductive material then cools and is again superconducting. The power can safely come on again. Thus the superconductive property allows the SFCL device to function like a switch.

### CHEAPER AND PRACTICAL

“Our advanced superconducting conductor makes the SFCL much more attractive from an economic point of view,” explains Pascal Tixador, project coordinator. “The new conductor is approximately one tenth the cost of the Nexans conductor.” These savings were mainly achieved by optimising the conductor with alternatives.

“We succeeded in developing and experimentally validating an advanced superconducting conductor for SFCLs,” adds Tixador. “But these developments took much more time than foreseen at the beginning of the project, and it was not possible to manufacture all the elements we hoped to.” The team manufactured, and successfully tested, two of a planned six superconducting elements.

The next step will be to finalise industrialisation of the superconducting conductor. When this can be manufactured more easily, testing can begin in a full-scale industrial environment.

The ultimate result will be a fault current limiter (fuse-like but reusable mechanism, usable at high voltages) cheap enough to be installed throughout national grids. Not only will the final device protect the grid from damage, it will also enable a long sought-after system reconfigurability called grid meshing.

### FASTGRID

- Coordinated by the National Centre for Scientific Research in France
- Funded under Horizon 2020-LEIT-NANO and Horizon 2020-LEIT-ADVMAT
- [cordis.europa.eu/project/id/721019](https://cordis.europa.eu/project/id/721019)
- Project website: [fastgrid-h2020.eu](https://fastgrid-h2020.eu)
- ▶ [bit.ly/fastgrid-video](https://bit.ly/fastgrid-video)

## INNOVATIVE RESEARCH FOR A POSITIVE VISION OF THE FUTURE OF WORK

As Europe emerges from the pandemic, it seems the world of work is fundamentally changing. But many of the underlying forces driving this change were underway even before COVID-19. The EU has been grappling with issues of social inequality, a lack of high-skilled jobs, insecure employment, and economic decline in many European regions.

To help Europe in its post-pandemic recovery, the European Commission has also recently launched its European Pillar of Social Rights Action Plan. This comprehensive strategy sets out 20 principles that aim to ensure a strong, social Europe that is fair, inclusive and full of opportunity by 2030.

As always, you need the research and innovative solutions to enable the policies. This is where this Pack's 11 projects come into play. They offer a treasure trove of ideas and comprehensive research, with a heavy emphasis on education, lifelong learning and developing new skills, automation and digitisation, social dialogue, and workplace organisation.

To find out more, browse, download or order a physical copy of the Results Pack here: [cordis.europa.eu/article/id/430165](https://cordis.europa.eu/article/id/430165)



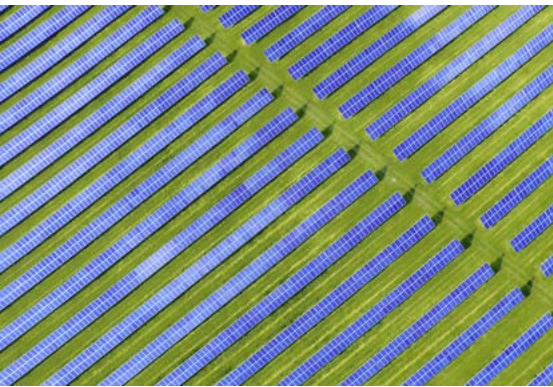




LIFE AFTER...

# Catching up with Crystal Tandem Solar: A truly transatlantic effort to develop super-efficient, cheaper and more flexible perovskite solar cells

*In the August/September 2020 issue of Research\*eu, in our Energy section, we met Giles Eperon, chief investigator of the EU-funded Crystal Tandem Solar project, part of the Marie Skłodowska-Curie Actions programme. He and his team were working on the development and refinement of highly innovative perovskite solar cells, which ultimately led him to the United States to continue his work once his fellowship was over.*



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In Crystal Tandem Solar (Single-Crystal Perovskite Tandem Solar Cells For High Efficiency and Low Cost), Eperon was deeply engaged in pushing the limits of perovskite technology. A breakthrough early in the project allowed him to focus entirely on perovskite as they realised that two layers of perovskite could be extremely efficient. The project led him to the United States, where he began working for the United States National Renewable Energy Laboratory (NREL) in Colorado, as well as co-founding the start-up, Swift Solar, based in the San Francisco Bay Area.

### From Europe to America

... and he is still based in the United States we discover at the beginning of our catch-up interview. “Indeed, I’m still working for Swift and we continue to have a small team based in NREL, though most of us are now in

California,” he begins. “Before the move though, we were based entirely in NREL for a time as they allow start-ups access to their facilities and expertise, which was invaluable for getting Swift up and running.” Eperon and his team also had privileged access to larger-scale equipment at NREL which otherwise would not have been possible.

When asked directly about the ongoing developments regarding their innovative perovskite technology, Eperon is admittedly a bit coy. “It’s going well – we’ve built our own lab [in California] that has been up and running for around a year and a half and we’re currently planning the next stage of scaling up,” he says. “Alas, I can’t disclose details yet, but we have some exciting industrial collaborations and interested parties that are prototyping our demo products. In short, things are moving quickly at the moment and I’m sure they’ll look very different in a year or so!”

### The importance of EU funding

When reflecting on his journey that ultimately led him to Colorado, Eperon is adamant that his EU funding was critical. “It enabled me to start doing research in the US, and that really allowed me to develop the strong links with not only the US academic

community but moreover, the founders of Swift and collaborators at NREL. Swift really grew out of a collaboration we had during my funded project.”

We end our interview on a more thoughtful note. “I think providing funding for talented researchers to move to other countries really opens the way for the cross-pollination of ideas, community links and collaborations. It certainly felt that way for me!”

### CRYSTAL TANDEM SOLAR

- Coordinated by the University of Cambridge in the United Kingdom
- Funded under Horizon 2020-MSCA-IF
- [cordis.europa.eu/project/id/699935](https://cordis.europa.eu/project/id/699935)



**Giles Eperon**  
Chief investigator –  
Crystal Tandem Solar project  
© Giles Eperon

“ I think providing funding for talented researchers to move to other countries really opens the way for the cross-pollination of ideas, community links and collaborations. ”



# Understanding ‘planetary waves’ helps forecast dangerous heatwaves

*Extreme weather events like heatwaves can have a devastating impact, causing increased mortality and suffering, as well as significant damage to the economy. Accurate predictions of extreme weather events can therefore deliver huge benefits to society by allowing time to adapt to the threat.*

The European heatwave of 2003 is believed to have been responsible for over 70 000 deaths. In 2010 a heatwave in Russia killed around 50 000 people and had a major impact on the wheat harvest resulting in economic losses of around USD 15 billion.

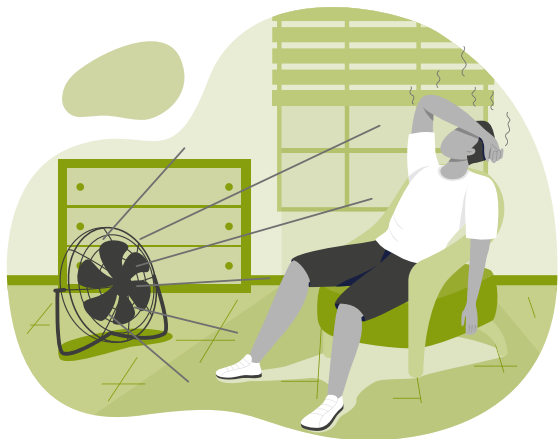
Many extreme events, including the European and Russian heatwaves, are associated with particular atmospheric circulation patterns – specifically the propagation of a type of atmospheric wave known as a Rossby wave along atmospheric waveguides.

Rossby waves, also known as planetary waves, are a type of large-scale wave in the atmospheric winds or ocean currents, with typical wavelengths measuring 100s to 1 000s of km. These waves occur naturally owing to the rotation of the planet. Waveguides are formed by particular configurations of the atmospheric winds, or the ‘jet streams’, the fast-flowing air moving from west to east in the upper atmosphere approximately 8-12 km above the Earth’s surface. Waveguides help determine the direction Rossby waves travel in, and thus what regions of the world they impact.

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## The European heatwave of 2003 is believed to have been responsible for over 70 000 deaths



### SEASONAL PREDICTABILITY EXAMINED

The EU-funded PROTECT (Propagation of atmospheric Rossby waves – connection to predictability of Climate extremes) project set out to investigate the connection between Rossby waves and extreme weather, as well as the predictability of such circulation patterns on sub-seasonal to seasonal (S2S) timescales to improve the prediction of the probability of extreme events several months in advance. The research was undertaken with the support of the Marie Skłodowska-Curie Actions (MSCA) programme.

The MSCA research fellow Rachel White studied atmospheric waveguides that trap Rossby waves within a certain latitude range of the Earth. “Trapping Rossby waves can allow them to be larger in amplitude and to remain in place for extended periods of time, both of which contribute to the occurrence of extreme temperature events. Although PROTECT focused on heatwaves, Rossby waves have also been shown in the scientific literature to be connected to extreme cold events and extreme rainfall,” White explains.

“Rossby waves have also been shown in the scientific literature to be connected to extreme cold events and extreme rainfall.”

### CONNECTION CONFIRMED

A key result of the project was the development of a data set containing daily maps of atmospheric waveguide occurrence. According to White: “Before this project, waveguides were typically studied in average conditions, as an average either over time or over longitude. However, PROTECT developed an objective algorithm to detect waveguides in data for winds observed over the past 35 years, allowing the waveguide data set to be produced.”

Analysis of the data set showed that waveguides are indeed associated with an increased occurrence of Rossby waves, especially slowly propagating Rossby waves that contribute to extended extreme temperatures such as heatwaves. “The research helped advance our understanding of the links between large-scale atmospheric circulation patterns and extreme weather events,” adds White.

The research initiated through the PROTECT project is ongoing, exploring the predictability of these waveguides in operational S2S forecast systems, which is an exciting route for potentially improving the ability to predict extreme events. “Results showing connections between waveguides and the types of Rossby waves that typically lead to extreme events suggest that improvements to the S2S prediction skill of heatwaves may indeed be possible using the approach laid out by the PROTECT project,” White concludes.

### PROTECT

- Coordinated by the Barcelona Supercomputing Center in Spain
- Funded under Horizon 2020-MSCA-IF
- [cordis.europa.eu/project/id/797961](https://cordis.europa.eu/project/id/797961)
- Project website: [eoas.ubc.ca/people/rachelwhite](https://eoas.ubc.ca/people/rachelwhite)

# Building urban resilience to climate change

*Cities are expected to bear the brunt of climate change and face increases in the intensity and occurrence of heatwaves, heavy rain, floods and other extreme weather events. EU researchers have developed groundbreaking solutions to deal with these disaster scenarios.*

It is estimated that around 66% of the world population will be living in urban areas by 2050. Aimed at aiding cities to cope with the effects of climate change, the EU-funded RESCCUE (RESilience to cope with Climate Change in Urban arEas – a multisectorial approach focusing on water) project set out to help urban areas around the world become more resilient. “More precisely, RESCCUE has provided innovative models and tools to improve the ability of cities to withstand and recover quickly from multiple climate-related shocks and stresses and maintain continuity of services,” explains Marc Velasco, project coordinator.

## THE ROAD TOWARDS RESILIENCE

With a focus on the urban water cycle and floods, the project’s key achievements are diverse. One of these is the generation of climate change scenarios for the three RESCCUE cities – Barcelona, Bristol and Lisbon – based on different climate variables such as temperature and rainfall. “These cities have become a testing platform

for the cutting-edge solutions developed in RESCCUE,” notes Velasco.

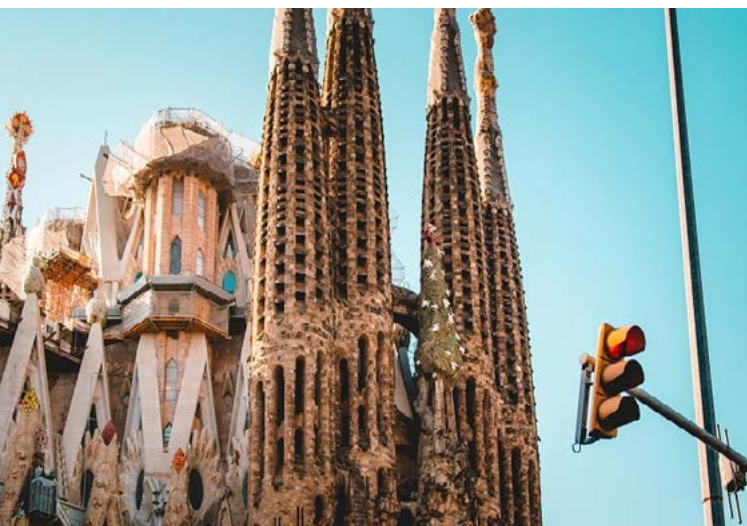
Additionally, sectorial models were created to provide deep knowledge of the response of urban services during extreme climate conditions, like heavy storms. “We also presented and tested different methodologies to develop a multiple hazard assessment for these services and their infrastructures,” Velasco adds.

Adaptation strategies, formed through sets of measures, can help cities adjust to climate impacts and increase their resilience. There are, however, many measures to choose from, which becomes challenging when urgent action is required. Assisting cities to prioritise adaptation measures, RESCCUE proposed a methodology that can be adapted to a variety of cities.

This methodology was tested in Barcelona, Bristol and Lisbon. “Based on the existing climate plans of the cities and workshops with stakeholders, the project proposed four strategies and 27 measures for Barcelona, three strategies and 14 measures for Bristol and six strategies and 24 measures for Lisbon,” says Velasco.

Focusing on the urban water cycle and bringing together the project’s work, Resilience Action Plans were also developed for RESCCUE’s three cities. These action plans provide a road map towards climate change resilience. “They are thematic plans contributing to their global planning. The urban services addressed in these plans were water supply, waste water, storm water, waste, electric energy and mobility,” explains Velasco.

All RESCCUE’s results, the main tools, models, data sets and methodologies, are showcased in an end user, city manager and urban service operator oriented toolkit. These solutions are ready to be deployed to different cities with different climate change pressures.



## MODELLING THE FUTURE

“What RESCCUE has produced is only the beginning. The work initiated will continue to move forward and cities will become more prepared for the coming challenges,” notes Velasco. The project’s methodologies and tools are expected to make a significant impact on the urban resilience sector in Europe, as they pave the way for city resilience assessment, planning and management in different urban environments.

Discussing what might come next, Velasco concludes: “Multi-hazard and impact models should be used to improve planning and operation of the main urban services to face climate change effects. Synergies with ongoing and future projects and experiences related to short- and mid-term early warning systems, including seasonal prediction, and long-term projections could help to cover this gap.”

“More precisely, RESCCUE has provided innovative models and tools to improve the ability of cities to withstand and recover quickly from multiple climate-related shocks and stresses and maintain continuity of services.”

### RESCCUE

- Coordinated by Aquatec in Spain
- Funded under Horizon 2020-ENVIRONMENT and Horizon 2020-SECURITY
- [cordis.europa.eu/project/id/700174](https://cordis.europa.eu/project/id/700174)
- Project website: [toolkit.resccue.eu](https://toolkit.resccue.eu)
- ▶ [bit.ly/resccue-video](https://bit.ly/resccue-video)

## CLIMATE CHANGE AND ENVIRONMENT

# How small farmers adapt to a changing climate

*Small-scale farmers in sub-Saharan Africa are one of the groups of people most vulnerable to climate change in the world. Hence, there is an urgent need to find sustainable rural development strategies that will increase their ability to adapt to changing conditions.*

The EU-funded ADAFARM (Small scale farmers’ sustainable adaptation strategies to climate change based on ecosystem services) project analysed sustainable climate adaptation options for small-scale farmers in Mozambique in south-eastern Africa. The research was undertaken with the support of the Marie Skłodowska-Curie Actions programme. “We focused on the role played by formal and informal institutions and key factors like poverty and gender,” says research fellow Pedro Zorrilla Miras.

Initial project work focused on the episodes of hunger due to climate hazards suffered by small rural communities, located in remote areas. “Our aim was to determine the importance of ecosystems as a coping strategy in these situations, and the different opportunities for farmers depending on the woodland cover within their communities,” he explains.

In a second phase, researchers investigated how the government and NGOs of Mozambique can improve communication with farmers and how the information can reach rural communities more effectively. “Specifically, we investigated the access to and exchange of information of small-scale farmers in Mozambique, to improve their access to information for adapting to climate change,” notes Zorrilla Miras.

## CAUSES OF HUNGER

Results related to the episodes of hunger suffered by small rural communities showed that more than 80% of the cases are due to climate hazards like droughts and floods, compared to other factors such as land scarcity, lack of agricultural inputs and pests. Zorrilla Miras remarks: “The most vulnerable families are female-headed households; related factors include having limited



© Pedro Zorrilla Miras

access to health and extension services as well as low levels of savings.”

The most common strategies for finding new sources of food involved borrowing from family or friends, consuming seeds that were being stored for the next growing season, informal jobs, and food and resources from the forest. Access to a local market was also found to increase the use of natural resources.

## ACCESS TO INFORMATION

The second set of results concerning access to agricultural information sources revealed significant territorial differences. According to Zorrilla Miras: “In rural areas far from the national capital, where there are higher poverty rates, access to information sources is very limited and intermittent.”

Hence, the use of small solar panels by small-scale rural farmers in Mozambique can be a disruptive technology for the future. “They increase the capacity to use mobile phones and smartphones, increasing local knowledge exchange and promoting big technological and social changes,” he adds.

Big gender differences have also been found in the use of information sources. Women make greater use of oral, direct and informal communications within their communities, whereas men use more radios and phones. Women’s illiteracy rates are also higher than men’s and represent a greater barrier to accessing new information than for men.

ADAFARM identified that the most important sources of information for farmers are agricultural extension services consisting of government staff working in direct contact with rural communities. “However, this is difficult due to limited government resources,” Zorrilla Miras says. “Ideally, they should support actors and activities related not only to agriculture, but also to the quality of life of the community, like local organisation, natural resources management, etc.”

These conclusions will be shared with the government of Mozambique, NGOs, universities and all other parties working on these issues, to guide and inform their strategies and policies. “Ultimately, the beneficiaries will be rural farmers and the conservation of ecosystems,” Zorrilla Miras concludes.

## ADAFARM

- Coordinated by ICATALIST in Spain
- Funded under Horizon 2020-MSCA-IF
- [cordis.europa.eu/project/id/798867](https://cordis.europa.eu/project/id/798867)
- Project website: [bit.ly/adafarm](https://bit.ly/adafarm)



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SPECIAL FEATURE

# FROM SOCRATES TO MODERN SCIENCE: NEW PERSPECTIVES IN EUROPEAN PHILOSOPHY

## Editorial

### “The answer to the ultimate question of life, the universe and everything is 42” – The Hitchhikers Guide to the Galaxy

It's likely that most people go through their everyday lives without really considering the value of philosophy or how it continues to exert an influence on the way society functions. For those of us who are exposed to the great thinkers of Western Philosophy, from Socrates onwards, it's usually only during our school and university education, and then after that we begin our careers and never really actively engage with these thinkers' ideas or works again.

So why is philosophy taught at all? Philosophy is the foundation of critical thinking, a skill which is absolutely essential in so many professions that now make up the 'knowledge economy'. And indeed, whilst our postmodern and post-industrial society is very different from the ancient civilisations that cultivated Plato and Aristotle, the fundamental nature of philosophy and its value to us as humans is the same now as it was then. Philosophy is essentially the human way of putting the 'big' questions about our lives and existence onto the table and working towards an answer. What is justice? What is right? What is happiness? What is a good life? What is the ideal society? What are we, actually? All of these questions are just as relevant today as they were all the way back in antiquity. One may grumble that these questions are pointless because we can never reach a conclusive answer, not in the way that scientists make an educated hypothesis, conduct the experiment and then reach a conclusion.

But that's not the point of philosophy. Science is indeed incredibly important (it's the backbone of this entire magazine of course) and we heavily rely on science and the scientific method to understand our world and advance our technological capabilities. With enormous upcoming challenges for the whole of humanity, such as the fight against climate change, science is indeed vital for our survival as a species. But this doesn't negate

what philosophy can still bring to the table. Philosophy helps us to evolve our morals, our values and helps us to conceive why favouring human happiness over human misery is not just in our material interest but is actually fundamentally right. In short, science doesn't have all the answers – it can help us to understand how the universe ticks, but it can't definitively tell us what our place in the universe is or what leading a 'worthwhile' life actually means. That's the realm of philosophy.

'Philosophy' itself is a highly multifaceted discipline, covering everything from political philosophy to metaphysics, to logic and mathematics, to the philosophy of language and linguistics and yes, the philosophy of science too. In essence, philosophy is the discipline of absolutely everything – it bleeds into and leaves its mark on every other academic discipline. Whatever your profession and wherever you live, you engage with philosophical ideas every day, mostly without realising it. Philosophy is the engine of our humanity.

Under Horizon 2020, large multi-country consortia comprising several major organisations are the most common structure of an EU-funded project. Naturally, this is not the case for EU-funded initiatives that focus on philosophy. But Horizon 2020 does fund promising and exciting individual researchers in the philosophy discipline, most commonly through the grants of the European Research Council (ERC) and individual fellowships of the Marie Skłodowska-Curie Actions programme. Through this special feature of Research\*eu, whilst we can't tell you the answer to the ultimate question of life, the universe and everything, we can shine a light on seven of those talented researchers and their work.

We look forward to receiving your feedback. You can send questions or suggestions to [editorial@cordis.europa.eu](mailto:editorial@cordis.europa.eu).

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## Placing realism in perspective

*An EU-funded project has developed a novel philosophical position to solve the conundrum of how scientific knowledge can be perspectival, and at the same time true. Perspectival Realism considers science, knowledge and truth from a human vantage point.*

Is there such a thing as physics beyond the Standard Model? What might dark matter and dark energy be made of? How do the answers to these questions formulated by scientists relate to the specific contexts in which they work – and what role do these contexts play in our quest for scientific knowledge?

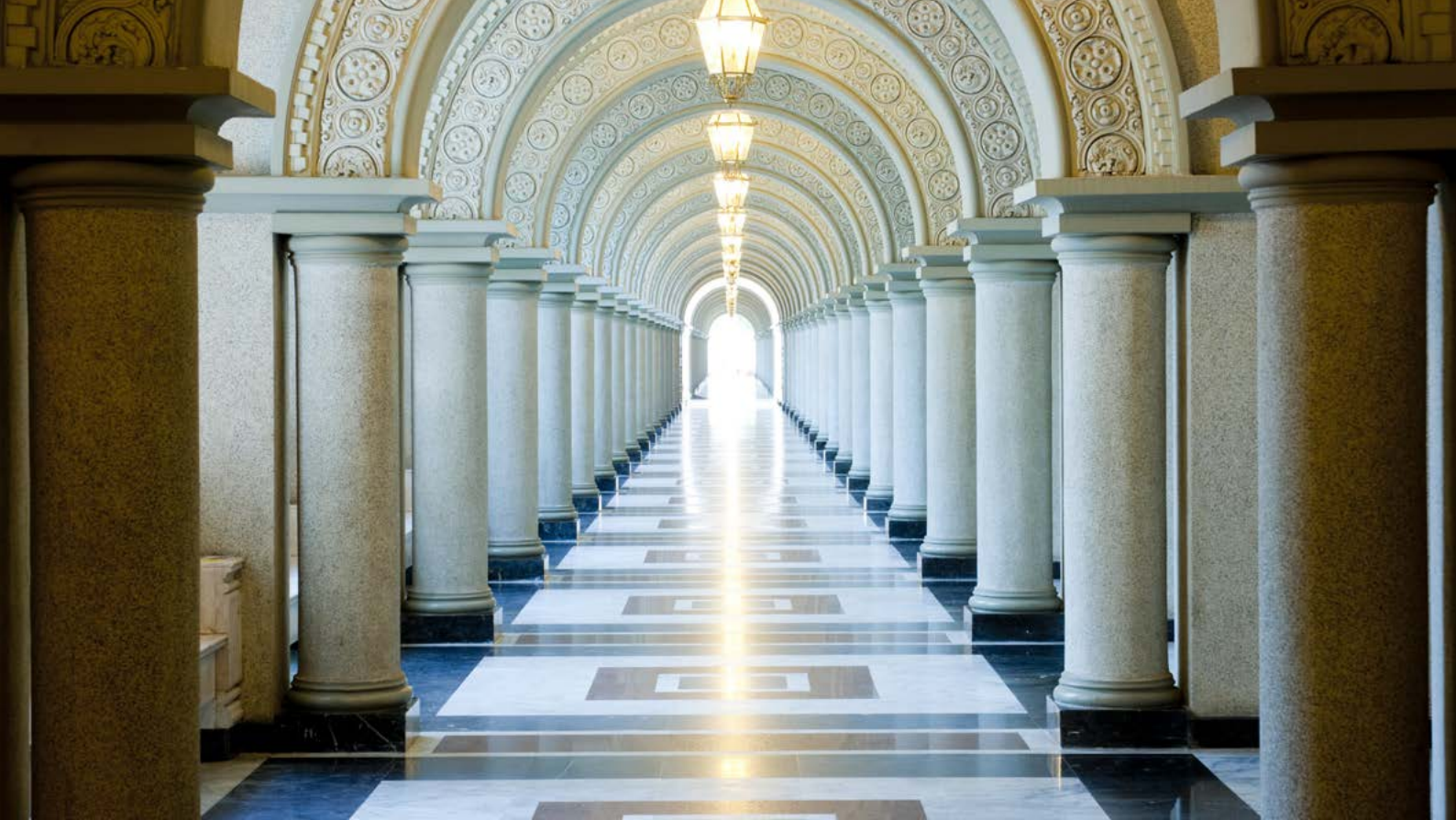
Traditionally, scientific realism is the philosophical view that sees the best theories in mature sciences as giving us an approximately true description of the way things are. But how can we expect science to describe things as they are, when we know that these descriptions are necessarily developed in a specific historical and cultural context, from a specific scientific perspective (e.g. that of contemporary particle physics and cosmology)?

### A VIEW FROM SOMEWHERE

“This definition of realism presupposes that there is some kind of ‘view from nowhere’ from which science can offer such an approximately true description,” explains Michela Massimi, professor of the Philosophy of Science at the University of Edinburgh. “However, scientific inquiry is always a ‘view from somewhere’: it is the product of historically and culturally situated epistemic communities that have the modelling resources, statistical tools, experimental instruments and so on to advance particular knowledge claims at their time. Scientific knowledge is always situated and perspectival knowledge.”

Her Perspectival Realism (Science, Knowledge, and Truth from a Human Vantage Point) project, which received funding from the European Research Council, aims to reconcile the notions of realism and perspectivism in science by rethinking what realism is about. “Perspectival Realism offers a novel view about realism in science that treats scientific knowledge production neither as the outcome of any lone genius nor as proceeding in disciplinary silos. Scientific knowledge is always the outcome of a social, multicultural and collaborative inquiry,” Massimi says.





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The project's interdisciplinary approach combines the philosophy of science with scientific practice, the history of science and the history of philosophy. It pays attention to the historical and cultural contexts of scientific claims and develops a variety of realism within the bounds of a plurality of scientific perspectives.

## TRUTH ACROSS PERSPECTIVES

Massimi argues that perspectival realism is centred on the identification of 'phenomena', which have been reliably inferred from data. This process is always perspectival, she points out, as the inferences are drawn by particular communities at particular times. The role of these numerous – historically and culturally different – communities in knowledge production therefore needs to be reconsidered. No scientific perspective can sanction the truth of its own claims, she notes: "Claims of knowledge must instead be assessable from the point of view of other scientific perspectives. This cross-perspectival assessment is key to the notion of 'perspectival truth': truth across scientific perspectives."

During the fieldwork with scientists carried out under the project, the team visited CERN and the Dark Energy Survey (DES), where questions about realism translate into specific searches for new particles, including candidates for dark matter. They found that a plurality of seemingly incompatible models could in fact prove methodologically crucial to exploring new physics in such cutting-edge areas of scientific inquiry.

“*Perspectival Realism offers a novel view about realism in science that treats scientific knowledge production neither as the outcome of any lone genius nor as proceeding in disciplinary silos.*”

“The philosophy of science can enter into fruitful conversations with contemporary science and offer the opportunity to collaborate with an eye to gaining a better understanding about the methodological assumptions behind scientific knowledge production,” Massimi concludes.

## PERSPECTIVAL REALISM

- Hosted by the University of Edinburgh in the United Kingdom
- Funded under Horizon 2020-ERC
- [cordis.europa.eu/project/id/647272](https://cordis.europa.eu/project/id/647272)
- Project website: [perspectivalrealism.org](https://perspectivalrealism.org)

# Found in translation: transformation as the essence of language

*Translation is the process that defines the transformational and historical character of language, according to the TRANSPHILEUR team. Viewing the history of cultures through the prism of translation could hold important lessons for Europe in particular.*

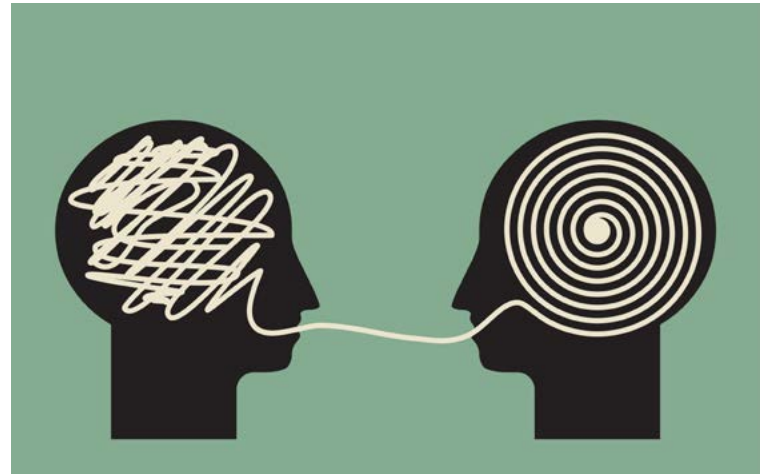
If you speak English as a second language or interact with people who do, you may have noticed how those contacts between different linguistic backgrounds contribute to shaping the language itself, from vocabulary to structure and meaning. Instead of trying to fight this phenomenon, we should embrace it as inherent to the transformational nature of language, says a team of European researchers.

The project TRANSPHILEUR (TOWARD A PHILOSOPHICAL RETHINKING OF TRANSLATION: Effects of Translation in a Contemporary European Space), which was undertaken with the support of the Marie Skłodowska-Curie Actions (MSCA) programme, looked at translation through the lens of philosophical inquiry, approaching it as self-reflective transformational practice. Saša Hrnjez, MSCA fellow and TRANSPHILEUR lead researcher, explains: “There is no translation without some change or modification of the text and its meaning. This transformational effect of translation has the character of reflexivity –in the sense not of a subjective act of thinking, but of a reflective process within languages that translate each other.”

This idea builds on an interpretation of Hegel’s dialectics, providing a novel view on the translational process by revealing its dialectical character. Hegel’s dialectics describe a process of ‘becoming-other’ through an interaction between identity and difference, structured as contradiction. The project carried out a philosophical framing of translation as an interaction between Hegel’s dialectics and translation theory. It proposes to rethink translation in the light of this dialectical structure.

## NO TRANSLATION, NO LANGUAGE

“Hegel’s logic can be seen as a sort of self-reflexive transformation of logical determinations: a constant tension towards self-mediation,” says Luca Illetterati, professor of Theoretical Philosophy at the University of Padua and TRANSPHILEUR project coordinator. If we rethink translation in the light of this dialectical structure, it appears that the role of translation is much more than a tool for communicating with speakers of other languages: “Due to its self-reflectivity, translation is not



a mere transition from one linguistic domain to another, but a transformative self-reference of both domains. Translation does not take place at the border of a segregated linguistic reality, but at the core of languages.”

The case of English as a lingua franca is a good case study of this transformational process in action. “When we express ourselves in English as non-native speakers, we actually translate, and we construct our English based on our own linguistic background. On the other hand, due to the omnipresence of English, we often translate from English even when we write in our mother tongues. A self-contained language is a fictional abstraction: language without translation is no language,” Hrnjez observes.

## SHAPING IDENTITIES

He believes that we should embrace the transformational power of this process, especially in the European context. “We could view the history of European cultures as a history of multiple linguistic and conceptual translations. This approach enables us to denounce exclusionist, identarian or particularistic linguistic policies in Europe.”

Europe’s history provides an illustration of the practical contribution of translation to the construction of political and cultural identities. Explicitly recognising this role could

“A self-contained language is a fictional abstraction: language without translation is no language.”

help to shape future European linguistic policy, Illetterati remarks: “Translation is always a political act, a concrete

discursive practice that not only mirrors political and social aspects of cultural interactions, but also structures them.”

## TRANSPHILEUR

- Coordinated by the University of Padua in Italy
- Funded under Horizon 2020-MSCA-IF
- [cordis.europa.eu/project/id/798275](https://cordis.europa.eu/project/id/798275)

# Comedic tricks for more inspired politics

*What if comedy could inspire a new take on politics as we know it? The Comedy and Politics project investigated their historical bond and the potential of this bond for future policymaking.*

Politics is no joke. Or is it? As citizens of long-lived democracies become increasingly disillusioned with politics, and COVID-19 takes a toll on our health and economies, questionable policymaking can become the laughing stock for frustrated citizens and inspired comedians alike. But the bond that unites comedy and politics is much deeper than that. Comedy has been inspiring political thought and political philosophy since the days of Plato, and many political protests in history have made use of comedic techniques. The only problem is, as strong as it may be, this bond seems to have recently been forgotten by political philosophers who would rather focus on tragedy instead or forget entirely about the arts.

“Tragedy can open our eyes to inherent tensions and conflicts that require political transformation. But the notion that political thought has been devoted to tragedy has blocked from view how comedy offers a different take on the same tensions and conflicts,” explains Thomas Khurana, former lecturer in Philosophy at the University of Essex and currently professor of Philosophy at the University of Potsdam.

There is indeed richness in avoiding the moralisation and rationalisation of politics inherent to tragedy, to approach it as a play of forces considering the absurdity, contingency, frailty and flaws of human action instead. Meanwhile, looking at comedy from a political perspective can reveal that the former is in fact quite serious.

Well aware of this potential, Khurana and Marie Skłodowska-Curie Actions fellow Birte Löschenkoehl set out to overcome the misrecognition of the political impact of comedy under the project Comedy and Politics (The Comedy of Political Philosophy. Democratic Citizenship, Political Judgment, and Ideals in Political Practice). “We felt it was helpful to uncover the whole depth of the literary and philosophical tradition of political comedy. We thus turned to major authors from antiquity to the early modern period, all the way up to modernity. We were especially interested in authors such as Plato, Machiavelli, Hegel and Marx, who are renowned for the significance of their political thought but unknown for the stakes they have in comedy,” says Löschenkoehl.

This effort offers a wealth of interesting insights. Even though Plato is mostly known for banning arts in general from the ideal political life, the project showed that he has a different take on comedy, suggesting that a comic disposition in citizens can be helpful to resolve tensions between political ideals and the reality of political corruption. Meanwhile, Marx’s critique of capitalism and his thoughts on the possibility of its transformations surprisingly turned out to rely on comedic techniques.



“*The notion that political thought has been devoted to tragedy has blocked from view how comedy offers a different take on the same tensions and conflict.*”

## URGENCY IN CONTEMPORARY DEVELOPMENTS

Comedy and Politics also looks closely at what's happening in our current political culture. It first considers the strange interconnection of comedy and authoritarianism which gives us pause about the positive potential of comedy. It also looks at the positive resources comedic thinking can offer in responding to present political challenges such as climate change.

“Adequate political responses to these challenges will all require acknowledging human finitude and vulnerability while confronting the arrogance and hubris inherent in our contemporary attempts to master nature. We seem to be stuck in a false alternative, which is either straightforward denial or giving in to tragic doomsday scenarios,” Löschenkohl adds. “Neither will be helpful in dealing with this mess and its systematic injustices. We can use the resources that comedy has to offer both to help us see the absurdity of our current attempts of mastering and engineering nature, and to learn how to act based on our own finitude and dependence.”

One of the project's key findings is the necessary distinction between delusional and fantastic comedies. “The rejection of the idea that comedy may be instructive for political thought has to do with the fact that all comedy is generally identified with the genre of delusional comedy: giving us false hope, inviting wishful thinking, or giving us an aggrandised picture of magical possible remedies,” Khurana notes. “With this project we show that there is a different tradition of political comedy that is fantastic rather than delusional. Once one gets this fundamental distinction into view, it becomes possible to connect with a form of radical political hope inherent in comedy that has nothing to do with delusion and self-deception.”

Löschenkohl and Khurana hope that Comedy and Politics will eventually contribute to a diversification of perspectives in political theory while providing contemporary discussion with new tools for better understanding the political and philosophical significance of comedy.

## COMEDY & POLITICS

- Coordinated by the University of Essex in the United Kingdom
- Funded under Horizon 2020-MSCA-IF
- [cordis.europa.eu/project/id/796718](https://cordis.europa.eu/project/id/796718)
- Project website: [bit.ly/politics\\_and\\_comedy](https://bit.ly/politics_and_comedy)

# Imagination's central role in shaping human knowledge

*We all use our imagination to escape our world for a mere instant, we dream about another life or immerse ourselves in a book. But what if our imagination provided us with glimpses of how the world could be, allowing us to learn more about how it actually is in the process?  
The CKI project has explored this eventuality.*

One of humanity's greatest gifts is our ability to think of the world as it could, should or shouldn't be instead of just taking stock of how it actually is. But it's all in our head, right? Not exactly. In many cases, this 'counterfactual thinking' is much more than a fantasised 'what if'. There can even be real cognitive benefits to this approach so long as we correctly assess counterfactual conditionals about how things could have been.

“The CKI project starts from the hypothesis that the imagination is the basic human way of assessing counterfactual conditionals,” says Marie Skłodowska-Curie Actions (MSCA) fellow Margot Strohming. “But imagination doesn't usually go unaided. Our brain needs information, statistical data, computer modelling and so on. At the end of the day, if we take the case of COVID-19, all that information feeds into an effort of collective

“ *The CKI project starts from the hypothesis that the imagination is the basic human way of assessing counterfactual conditionals.* ”

imagination to assess whether the right measures have been taken at the right point in time. We use this same basic process to evaluate other claims of the imagination, for example claims about whether something is possible or impossible.”

Whilst traditional research approaches tend to treat fiction as the primary purpose of our imagination and ignore its more basic cognitive role, CKI (Counterfactual Knowledge from the Imagination) sees it first and foremost as a tool sketching possible worlds to help us learn more about the one around us. The idea of such possible worlds has long been used by David Lewis (a very influential 20th century philosopher), who even went as far as to consider them as real and coexisting with the world we live in. Whilst CKI doesn't go quite as far, the project uses this familiar philosophical concept to better understand counterfactual conditionals.

## THE MISSING BRIDGE

“A possible world is like a story complete in every detail, leaving no question unanswered unlike any novel ever written,” adds Timothy Williamson, professor of Logic at the University of Oxford and principal investigator for the MSCA-supported CKI project. “But whilst we can never grasp the extent of such a counterfactual world, we can still come to know some of its conditionals and reason with them. For example, I might find out that if I had taken another road, I wouldn't have been stuck in a traffic jam.”

Over the course of 2 years, the two researchers released several enlightening articles on the matter. In turns, they shed new light on the use of basic heuristics to assess conditionals (if X, then Y) or analysed how we use imagination to answer many ordinary modal questions (for instance, is it possible for me to run 10 km in under an hour tomorrow?). They even demonstrated that very similar imaginative processes underpin paradigms of a priori knowledge and paradigms of a posteriori knowledge.



“In another example, the project has found some close analogies between learning from imagination and learning from vision and other forms of sense perception. It has also confirmed the initial hypothesis that the basic human way of assessing counterfactual conditionals is in the imagination, by showing how much about the imagination it can explain,” Williamson explains.

Overall, CKI provides a refreshing look at the imagination as central to human knowledge. It shows how art, video games, novels or movies are more of a bonus than its core purpose. With the project now completed, Strohminger has decided to start a new project on how we attribute mental states to others (a feat sometimes called 'mind-reading') in the imagination.

## CKI

- Coordinated by the University of Oxford in the United Kingdom
- Funded under Horizon 2020-MSCA-IF
- [cordis.europa.eu/project/id/747658](https://cordis.europa.eu/project/id/747658)

# Decrypting the many purposes of language

*Sometimes language can tell us more about the intentions and mood of the person speaking than the type of society we live in. The Language Use project builds upon this observation to provide a new metasemantic proposal.*

In its quest to study the foundations of meaning, metasemantics (a branch of the philosophy of linguistics and metaphysics) essentially defines language as a means of cooperation. But is that really all there is to it? Surely, language largely contributed to the ascent of humankind and played a fundamental role in the organisation of our incredibly complex societies. But as her interest was piqued by work from her predecessors, Jessica Keiser from the University of Leeds couldn't help but notice how the many other functions of language have been ignored for too long.

With the Language Use (Languages and Language Use) project, the Marie Skłodowska-Curie Actions fellow aims to depart from existing approaches to metasemantics by studying the relationship between language and the actions and mental state of its users. A few months from project completion, Keiser agreed to discuss her work and findings.

**Your project questions the idea that language is based on a convention of cooperative information exchange. Why? What problems did this pose?**

Jessica Keiser: This idea is problematic as it ignores many uses of language that are ubiquitous. For instance, language use is not always cooperative. We often resort to it strategically for conflicting purposes, be it in political debates or even with our children and intimate partners. Even when language is indeed cooperative, it's not necessarily used for information exchange. We can use it to tell stories, make jokes, socially bond, perform rituals, etc.

**How did you come to identify these problems?**

It was in graduate school when I was first exposed to standard literature on linguistic conventions. The orthodox story is that we use language to exchange information in a joint project to learn about the world. The idea is that everyone is going around asserting truths and expecting others to do the same. This immediately struck me as contrary to my experience of the world. I would not characterise the bulk of my linguistic exchanges as

aimed at exchanging information, and I certainly do not take it for granted that its default function is to assert only truths and expect the same from others. This made me want to understand what led traditional theorists and philosophers to think about language in this way, and where exactly they went wrong.

**How did you proceed to study the link between language and actions/mental state and what makes your approach particularly innovative?**

I looked at what was common to all uses of language. My approach is different in that it does not feed from a particular conception of the function of language. Where traditional theorists went wrong, I think, was when they began their inquiry from the assumption that language is used for cooperative information exchange and then built their theory around that assumption. In reality, this is a rather dry and scientific conception of language that ignores facts about language in the real world. I rather try to look at language use as it is, and then develop a conception of its function.

**What are the project's most important findings so far?**

My hypothesis is that a common and core feature of language use is attention-direction. The principal goal of linguistic communication is to direct the attention of others to specific content. But we may do this with a myriad of different end results in mind. We may, as traditional theorists assumed, direct the audience's attention for the purpose of exchanging information. However, we may also want to direct their attention to something with a view to amuse them, for instance, or even to deceive or manipulate them.

**What do you still need to achieve before the project's end?**

I still need to do more research on the nature of attention. In particular, I'm interested in the question of whether attention is always conscious. I don't think that, when we communicate linguistically, we always want to draw our audience's attention to something in a conscious way. Sometimes we just want to make them aware of it on



**Jessica Keiser**  
Language Use MSCA fellow  
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“ *Where traditional theorists went wrong, I think, was when they began their inquiry from the assumption that language is used for cooperative information exchange and then built their theory around that assumption.* ”

some sort of subconscious level. A concrete example is when politicians use xenophobic dog whistles and propaganda. If I end up finding that attention must necessarily be conscious, then I'll need to appeal to a weaker attention-like mental state that's not conscious, at least in some cases.

**If you manage to provide a novel metasemantic proposal, what do you hope will be its long-term impact on our understanding of language?**

I hope to provide a framework for thinking about the nature and function of language that extends beyond cooperative information exchange. If successful, I hope this will enable us to expand the scope of our inquiry and understanding to a broader and more diverse range



of linguistic phenomena. Ultimately, I hope that this can serve ameliorative projects. For instance, the more we understand the mechanisms behind oppressive uses of language, the better we will be positioned to mitigate them.

#### LANGUAGE USE

- Coordinated by the University of Leeds in the United Kingdom
- Funded under Horizon 2020-MSCA-IF
- [cordis.europa.eu/project/id/845374](https://cordis.europa.eu/project/id/845374)

## A fresh look at Nietzsche's genealogy of morality

*With his Genealogical thought project, Emmanuel Salanskis questions the origins and meaning of an approach that has been inspiring philosophers for generations.*

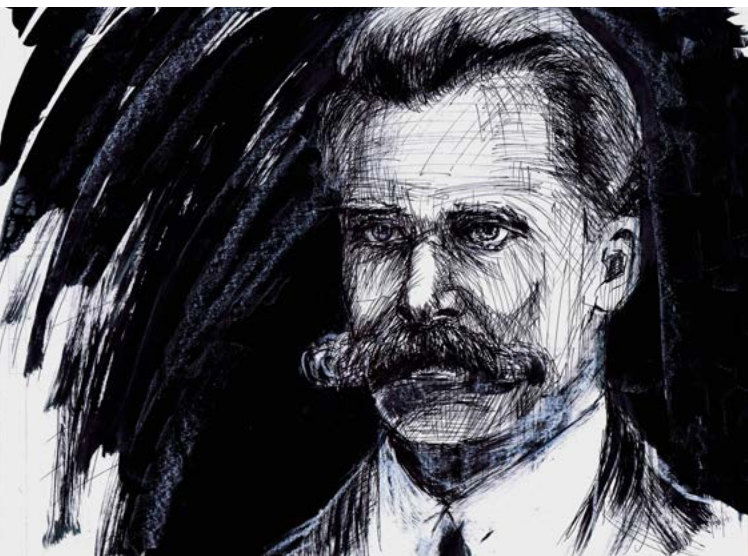
In 1887, Friedrich Nietzsche took philosophers across the world by surprise with a genealogical approach to moral issues. With his 'genealogy of morality', he did not only give a whole new meaning to a notion that used to be strictly confined to family ancestry and natural history. He seemingly redefined what it meant to be a philosopher and, in doing so, inspired many others after him who started working on a definition of his 'genealogical method'.

"In the wake of Gilles Deleuze's influential book 'Nietzsche and Philosophy' published in 1962, many French scholars started theorising 'genealogy' as a specifically Nietzschean method. Deleuze's double thesis was that Nietzsche had created the new concept of genealogy, and that Nietzschean philosophers should become

genealogists," explains Emmanuel Salanskis, associate professor of Modern and Contemporary Philosophy at the University of Strasbourg.

Fascinated by Nietzsche's metaphor since he was a student, Salanskis eventually noticed how Deleuze, Foucault and other commentators all seemed to have a different understanding of what the genealogical method really is. As Nietzsche himself never answered this question, he decided to take a new approach under the Genealogical thought (Genealogical Thinking in Nietzsche's Wake (19th-21st Centuries)) project.

"My goal in the Marie Skłodowska-Curie Actions project was to study post-Nietzschean genealogies in a more methodical way," he adds. "I wanted to show how the



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word ‘genealogy’ has been successively reappropriated in ways that have substantially modified its meaning, in accordance with Nietzsche’s general historiographical principle that ‘the form is fluid, the “meaning” even more so’. In other words, the genealogical tradition is more a series of creative deformations – the first of which has been performed by Deleuze – than a continuous transmission of an identical concept.”

### DIFFERENT INTERPRETATIONS

After a thorough investigation, Salanskis made two interesting breakthroughs. The first was that, as highlighted by Peter Kail in 2011, Nietzsche never claimed to be the first to offer a genealogy of morality. He rather opposed himself to earlier versions of genealogy. The second finding was that not a single commentary of Nietzsche’s genealogy was published before Deleuze’s in 1962.

“It seems extremely likely that Deleuze invented Nietzsche’s so-called ‘concept of genealogy’ in accordance with his own definition of philosophy as ‘the discipline that involves creating concepts’,” Salanskis notes. “Indeed, Deleuze’s commentaries as a historian of philosophy are themselves intended to be philosophy in the Deleuzian sense. In ‘Letter to a Harsh Critic’, Deleuze went as far as to speak ironically of a monstrous begetting: ‘I saw myself as taking an author from behind and giving him a child that would be his own offspring, yet monstrous.’”

Besides shedding light on the true origins of the genealogical concept, the Genealogical thought project also provides a better understanding of what genealogy actually meant to Nietzsche. Rather than claim paternity,

“ I wanted to show how the word ‘genealogy’ has been successively reappropriated in ways that have substantially modified its meaning.”

the philosopher did his best to conceal it and apply the new concept to earlier authors he wanted to criticise.

Salanskis also highlights the crucial difference between the genealogical receptions of Deleuze and Foucault: “Whereas Deleuze’s reading tends to de-historicise ‘genealogy’ precisely because Deleuze interprets it as conceptually distinct from history, Foucault refuses to oppose his own Nietzschean genealogical practice to history: On the contrary, he affirms in a famous 1971 paper on ‘Nietzsche, Genealogy, History’ that a well-conceived genealogy is nothing more than an effective history (*wirkliche Historie*). One can thus wonder if Foucault is not in fact a true continuator of Nietzsche’s original genealogical project.”

### EXTENDING THE GENEALOGICAL TRADITION

By showing that the genealogical tradition has not ceased to reinvent itself in the great authors who contributed to it, Salanskis suggests that this tradition remains open and alive today. He even has his own plans to extend the work initiated by Nietzsche and Foucault on the genealogy of Christianity in Greco-Roman antiquity, as well as pursue the genealogy of ‘guilt’ from antiquity to our contemporary world.

“There are many contemporary political issues that can be addressed from a genealogical perspective, regarding gender, race or religion. So, the long-term contribution of my project should be to show the multifaceted relevance of philosophical genealogy to interpret and transform our current social world,” he concludes.

### GENEALOGICAL THOUGHT

- Coordinated by Saint-Louis University in Belgium
- Funded under Horizon 2020-MSCA-IF
- [cordis.europa.eu/project/id/787525](https://cordis.europa.eu/project/id/787525)
- Project website: [nietzschealogies.hypotheses.org](https://nietzschealogies.hypotheses.org)



# Reconciling subjectivity and objectivity in science

*Subjective choice and objective knowledge are no opposites in science: rather, subjective elements are inevitable in scientific inference and need to be explicitly addressed to improve transparency and achieve more reliable outcomes, says a team of EU-funded researchers.*

What's the difference between the Trump team's 'alternative facts' and scientific truth? Objective methods of scientific inference is the standard response. But while there is an – objective – difference between scientific facts and falsehoods, the idea that sound science is free of personal values or subjective assumptions can lead to dangerous biases.

The Objectivity (Making Scientific Inferences More Objective) project, which received funding from the European Research Council, is rethinking the concept of objectivity in scientific inference. Outdated ideas of scientific objectivity as being free of any subjective element often hinder the promotion of scientific progress, remarks Jan Sprenger, principal investigator of the project and professor of the Philosophy of Science from the Department of Philosophy, University of Turin. “Unfortunately, many scientists and journal editors tend to sweep these elements under the carpet.”

According to Sprenger, this practice has contributed significantly to the ongoing replication crisis, which sees researchers struggle to reproduce the results of previous

experiments. “We have argued that an explicitly subjective stance on scientific inference increases the transparency of scientific reasoning. Thus, it also facilitates the verification of scientific claims and contributes to a higher degree of reliability of the conclusions.”

So how do we translate this approach into better science? The project team developed practical tools for improving statistical, causal and explanatory inference reconciling subjective choice with the aim of objective knowledge.

## SUBJECTIVITY BUILT-IN

One example of statistical malpractice contributing to the replication crisis is p-hacking, where researchers select the analysis or data that best fits the desired conclusion. The Objectivity team highlights the promise of Bayesianism, which uses the subjective interpretation of probability, for improving statistical inference: their work shows that experiments designed and analysed using this method led to more accurate estimates compared to the conventional method.



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“*Science is superior to superstition not because it does not allow for subjective elements, but because its conclusions are rather resistant to variation in subjective input, and because it allows for rational criticism of the assumptions it makes.*”

Causal inference is the process through which causes are inferred from data. In medicine, for instance, randomised controlled trials aim to measure causal strength to study the effectiveness of a new treatment. The researchers argue for a specific measure of causal strength: the difference that interventions on the cause make for the probability of the effect. This probability can be interpreted objectively (as frequencies, propensities, etc.) or as subjective degrees of belief, dependent on the context.

Explanatory inference is the process of choosing the hypothesis that best explains the data at hand. This concept has been notoriously vague, notes Sprenger: “What is a ‘good’ explanation? The gut feeling of a scientist? In our work, we have provided a rigorous foundation of this mode of inference via the construction and comparison

of various measures of explanatory power.” The team identified a close relationship between prior beliefs and explanatory power. The quality of an explanation, and the inference of the ‘best explanation’, is hence not a purely objective matter, but entangled with subjective beliefs.

“Procedures for evaluating experiments and their statistical analysis should be adapted: we need to lose our fear of subjective elements in inference,” Sprenger concludes. “Science is superior to superstition not because it does not allow for subjective elements, but because its conclusions are rather resistant to variation in subjective input, and because it allows for rational criticism of the assumptions it makes.”

#### OBJECTIVITY

- Hosted by the University of Turin in Italy
- Funded under Horizon 2020-ERC
- [cordis.europa.eu/project/id/640638](https://cordis.europa.eu/project/id/640638)
- Project website: [msio.wordpress.com](https://msio.wordpress.com)



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# Improved seasonal forecasts to optimise crop management

*Global climate change could threaten food security with an increase in the frequency and intensity of extreme weather events and prolonging droughts. European researchers explored how best to exploit existing climate information to improve crop management decisions and limit climate change impacts on our food supply.*

The seasonal prediction of climate-driven impacts on agriculture is still in its infancy. Our inability to accurately forecast seasonal climate variations could have devastating impacts on crop yield as we are unprepared for extreme weather conditions.

The EU-funded CLIM4CROP (Climate monitoring and seasonal forecast for global crop production) project explored the best way to exploit seasonal forecasts on a global scale for evidence-based crop management decision-making by applying the latest advances in climate and crop sciences. With support from the Marie Skłodowska-Curie Actions (MSCA) programme,

researchers used climate information, which included the most complete and up-to-date sets of seasonal forecasts.

Long-term archives combined with near-real-time data are crucial for monitoring and forecasting crop yields. CLIM4CROP characterised the uncertainties in global data sets of climate observations from the last three decades. “We also developed statistical models to better understand the relationship between climate and crop yields and to investigate the seasonal predictability of crop yields,” says MSCA research fellow Marco Turco from the Barcelona Supercomputing Center.



## NEW MONITORING TOOL

Scientists first evaluated the quality of long-term and continuous climate data by considering the Standardised Precipitation Index (SPI). Worldwide, SPI is a commonly used indicator for characterising drought over a range of timescales. Over short timescales, the SPI is closely related to soil moisture. At longer timescales, the SPI can be used to estimate groundwater and reservoir storage. This index can also be compared across regions with markedly different climates.

Researchers also created the DROught Probabilistic (DROP) data set to monitor drought via a probabilistic approach. This climate monitoring tool uses an ensemble of observations to obtain the best estimate of precipitation together with its associated uncertainty.

DROP is inspired by the multi-model approach in weather and climate prediction and offers complementary information to enhance existing climate data sets. "With DROP we first evaluated the quality of long-term and continuous climate data for timely meteorological drought monitoring," explains Turco. "Then, by applying an ensemble approach, mimicking weather and climate prediction methodologies, we developed DROP as a new global land gridded data set in which an ensemble of observation-based data sets is used to obtain the best near-real-time estimate together with its associated uncertainty."

## BETTER CROP MANAGEMENT

The DROP data set was published in the Bulletin of the American Meteorological Society (BAMS). The data set represented values taken from a set of grid points for drought monitoring and is invaluable for both the scientific community and the public. "This new data set will improve understanding of the interaction between climate and crop yields, and new insights allowing more efficient crop management, thereby helping

“ *The quantification of the uncertainties in drought monitoring for agricultural purposes is crucial for translating data into actionable information. Hence, CLIM4CROP can provide the essential accurate and timely drought information needed to move from post-disaster to pre-impact drought risk management.* ”

policymakers and commercial entities by allowing timely global policy decisions on adaptation priorities and helping alleviate drought impacts, especially in countries where meteorological monitoring is still challenging,” remarks Turco.

It is hoped that the high-quality and probabilistic information provided by DROP will be useful for monitoring applications and can serve as a reference for calibrating and validating climate-crop models. It can also be used to develop an integrated climate crop model that combines empirical crop models with climate seasonal forecasts while accounting for the observational uncertainty.

“The quantification of the uncertainties in drought monitoring for agricultural purposes is crucial for translating data into actionable information. Hence, CLIM4CROP can provide the essential accurate and timely drought information needed to move from post-disaster to pre-impact drought risk management,” Turco concludes.

## CLIM4CROP

- Coordinated by the Barcelona Supercomputing Center in Spain
- Funded under Horizon 2020-MSCA-IF
- [cordis.europa.eu/project/id/740073](https://cordis.europa.eu/project/id/740073)
- Project website: [bit.ly/CLIM4CROP](https://bit.ly/CLIM4CROP)

# New containment system for open water fish farming

*A new closed-cage system developed with EU funding creates an environmentally friendly, biosecure habitat for raising Atlantic salmon. This means fish avoid contact with the surrounding marine environment to minimise pollution and disease outbreaks.*

Production of Atlantic salmon in Norway has plateaued in recent years due to the temporary restrictions placed by the authorities to combat the spread of diseases, sea lice and fish escapes. These challenges, which affect the marine environment and ecological biodiversity, can be resolved by rearing Atlantic salmon in closed-cage aquaculture systems (CCASs).

The EU-funded NEPTUN (Novel closed-cage system for high-value marine aquaculture) project developed and piloted the next generation of floating inshore CCASs, offering the full range of necessary features for a stand-alone aquaculture system to produce salmon. "NEPTUN technology addresses major issues in aquaculture to intensify fish growth and create a basis for knowledge-based decisions in fish production," says project coordinator Håkon Lund Bondevik from Norwegian SME Aquafarm Equipment.

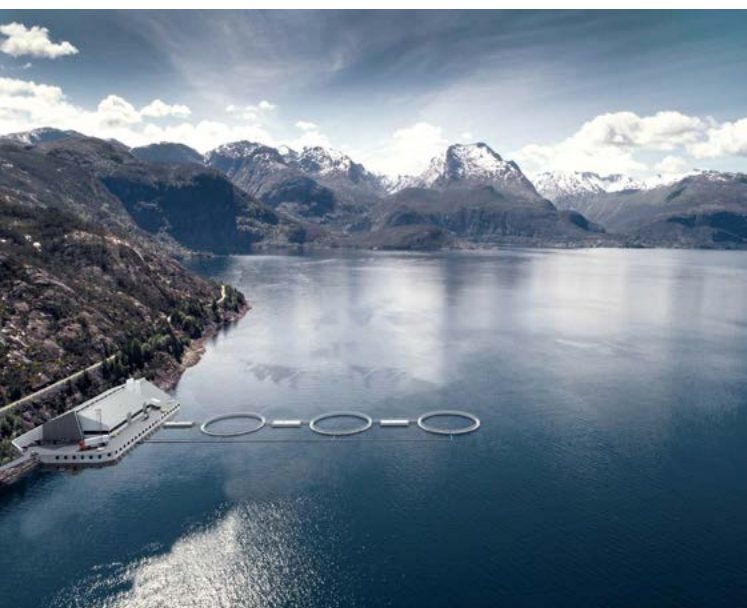
## A NOVEL DESIGN

The NEPTUN CCAS combines an impermeable and durable fibreglass enclosure with an innovative hatch technology to eliminate fish escapes and the need for chemical treatment to prevent sea lice infestation and algae growth. It is equipped with eight separate, adjustable water intakes located at 25-35 m below sea level to avoid pumping surface waters, where the parasites live, into the cage.

The water is drained through a strainer and transported through eight respective water treatment systems before entering the 21 000 m<sup>3</sup> fibreglass enclosure. These sophisticated water treatment systems consist of a particle filter, UV reactor and oxygenation equipment integrated into a floating collar.

The cage, which is designed to withstand significant wave heights up to 2 m, also facilitates efficient wastewater and sludge removal. The fish waste may optionally be transported through a pipeline to a self-developed waste separator unit where it is dewatered and later transported to a waste handling company.

Every single production parameter on the NEPTUN system is logged to provide users with an analytical, knowledge-based decision-making platform that can reduce operational costs, enhance fish welfare and promote a safer working environment. The internal stream simulates sea currents and ensures continuous water flow within the cage for optimal swimming velocity and motion. Test results indicate significant improvement in the feed conversion ratio and fish survival compared to conventional open aquaculture systems (OASs).



## MULTIPLE BENEFITS

The NEPTUN system is large and robust enough to withstand environmental forces found in coastal fish farming, allowing the industry to use the maximum allowed biomass and larger fish densities without any detrimental effect on fish health or the environment. The result from the development work performed throughout the Horizon 2020 project is a fully functioning CCAS, currently holding 775 000 smolts that will stay in the tank until they reach a weight of 1 kg. Afterwards, the fish will be transferred to an OAS plant to reach slaughter weight.

The closed-cage system has many proven advantages, such as no need for delousing, improved feed factor, reduced mortality, controlled water quality and oxygen saturation. "The NEPTUN concept is essentially redefining what is possible in sea-based aquaculture from a technological and biological perspective. The industry has undergone a vast transition from an experience-based to a

“*The NEPTUN concept is essentially redefining what is possible in seabased aquaculture from a technological and biological perspective. The industry has undergone a vast transition from an experience-based to a knowledge-based industry, which we seek to take part in.*”

knowledge-based industry, which we seek to take part in," Lund Bondevik concludes.

### NEPTUN

- Coordinated by Aquafarm Equipment in Norway
- Funded under Horizon 2020-FOOD and Horizon 2020-SME
- [cordis.europa.eu/project/id/778453](https://cordis.europa.eu/project/id/778453)
- Project website: [aquafarm.no](https://aquafarm.no)

## FOOD AND NATURAL RESOURCES

# Vision technology rejects unsuitable olives

*To ensure that only the best olives are used to produce extra virgin olive oil, an EU-funded project has developed an advanced sorting system. This will allow producers to maintain the highest quality in the face of increasing global competition.*

Olive oil is scientifically proven to benefit health and has become increasingly popular among consumers in wealthier countries such as Australia, China and the United States. Southern Europe is both famed for its olive oil and responsible for nearly 70% of global production.

The highest oil quality is known as extra virgin olive oil (EVOO) and is made from pure, cold-pressed olives, unlike regular olive oil that comprises a blend of both cold-pressed olives and processed oils. Effectively sorting the olives according to their quality and/or maturity before oil production commences is crucial to ensure the highest quality in a sector moving towards intensive cultivation, mechanical harvesting and large-capacity processing plants.

The EU-funded EVOOLUTION (Extra Virgin Olive Oil – Advanced Sorting Solution) project developed an advanced sorting solution that gathers information on each individual fruit entering the system at a rate of millions of olives per hour, removing defective olives before they

“*EVOOLUTION can and will be employed in other sorting applications within the food industry, such as fresh or processed fruit and vegetables, nuts, etc.*”

can enter the oil mill. “The technology can handle any issues concerning the quality of olives, anywhere in the world and for any type of olive grove,” says Carlos de Miguel, business director of the coordinating SME Multiscan Technologies SL.

## ONLY THE BEST WILL DO

The advanced sorting solution will help to ensure the efficient classification of olives before they are processed. “Unwanted defective, damaged, overripe or ground picked olives often enter the oil mill by mistake, reducing oil quality. If the resulting oil cannot be categorised as EVOO, its market value is then greatly lower,” de Miguel explains.

The technology comprises a state-of-the-art high-frequency multispectral vision system for high detection efficiency, together with advanced algorithms and modelling. “The system measures the olives’ physical properties and maturity index (MI) to ensure that defective and unwanted specimens are removed and don’t enter the milling phase. The advanced modelling and precise measurement of the olive MI are important for adjusting the organoleptic profile of the EVOO,” he adds.

Once designed and built, the vision system was tested with samples of olives supplied by collaborating growers. “The prototype was installed in oil mills in Chile, Portugal and Spain, and validated under real-world conditions during the harvesting season. End-user trials in oil mills from both Europe and South America helped ensure that the EVOOLUTION technology perfectly matched the needs of the oil producers,” de Miguel notes.

## WIDE APPLICATION IN THE FOOD INDUSTRY

EVOOLUTION technology will provide efficient sorting at the high processing volumes required by the industry. EVOO producers will therefore be able to guarantee quality regardless of external factors in the groves, extend the time window for obtaining higher grade EVOO,



© Multiscan Technologies

modulate the organoleptic profile of the oil and gather valuable data about the incoming fruit.

This translates into higher revenues and lower potential losses and paves the way for sustainable, high-quality olive oil. The know-how developed will also prove very useful for similar applications within the food industry. “EVOOLUTION can and will be employed in other sorting applications within the food industry, such as fresh or processed fruit and vegetables, nuts, etc.,” concludes de Miguel.

## EVOOLUTION

- Coordinated by Multiscan Technologies in Spain
- Funded under Horizon 2020-Societal Challenges, Horizon 2020-SME and Horizon 2020-LEIT
- [cordis.europa.eu/project/id/811930](https://cordis.europa.eu/project/id/811930)
- Project website: [bit.ly/3yLahFU](https://bit.ly/3yLahFU)
- ▶ [bit.ly/EVOOlution](https://bit.ly/EVOOlution)



## INDUSTRIAL TECHNOLOGIES

# Helping heavy industry clear the air

*An innovative new filterless air pollution abatement system is set to help enable a more sustainable manufacturing industry.*

Heavy industry is a major contributor to climate change and responsible for emitting over a million tonnes of gaseous pollutants every year. In Europe, industrial processes account for 7% of all greenhouse gases and nearly 877 million tonnes of CO<sub>2</sub>.

The damage caused by this pollution extends well beyond climate change – it also impacts the health and well-being of EU citizens.

According to one estimate, 90% of EU citizens are exposed to harmful levels of pollutants above the air quality guidelines of the World Health Organization. Furthermore, air pollution produced by industry has been connected to approximately 600 000 premature deaths and countless other diseases.

To help industry clean up its act, tech company IS CLEAN AIR Italia has developed an innovative, filterless air pollution abatement (APA) system for industrial processes. “Through its efficient method of cleaning and purifying ambient air, our APA technology lowers industry’s carbon footprint,” says Giuseppe Spanto, the company’s managing director.

“In doing so, it plays an influential role in enabling a more sustainable manufacturing industry.”

Supported by EU funding, the APA (Filter-less water-based Air Pollution Abatement system) project brought the company’s solution one step closer to marketisation.

### MORE EFFECTIVE AND TARGETED AIR PURIFICATION

The APA system effectively cleans the air within a radius of 25-30 metres and, when deployed in clusters, potentially an entire industrial facility.

The solution removes everything from particulate matter to heavy metals, hydrocarbons, pollen, spores, nitrogen oxides, sulfur oxides, and carbon. It does this using a patented centrifugal force process that converts the pollution into a water-based by-product that is easy to then process.

“A key differentiator of our solution is that it can be positioned both in working environments on the ground level and at the air discharge points of industrial processing machines,” explains Spanto.

“This means workers benefit from a more effective and targeted air purification, resulting in a healthier working environment.”

### MOVING TOWARDS MARKETISATION

The company used the EU funding to develop the final trial and configuration of its solution in preparation for its market entry. Specifically, the company implemented and validated numerous installations in real-world polluted and polluting environments.

“Our tests confirmed that our technological solution is able to successfully remove the widest range of harmful pollutants and even microorganisms as small as viruses,” adds Spanto.

As the company turns its attention to marketisation, it has integrated its value chain with several leading industrial players and business partners, along with building up its own internal capacity.

At least **90% of EU citizens** are exposed to harmful levels of pollutants







“We signed several technology transfer commercial and cooperation agreements that accelerate our marketisation efforts,” remarks Spanto. “We’ve also been granted patents in such key markets as Europe and the United States.”

### A STEP CHANGE IN AIR PURIFICATION

According to Spanto, APA is now well-positioned to compete on the global market.

“Our solution represents a step change in industrial air purification, one that will benefit the health and well-being of both the environment and people,” concludes Spanto.

“Thanks to the support of the EU funding, we are now in a unique position to become a global leader in the ambient air cleaning and pollution abatement sector.”

### APA

- Coordinated by IS CLEAN AIR in Italy
- Funded under Horizon 2020-ENVIRONMENT and Horizon 2020-SME
- [cordis.europa.eu/project/id/806756](https://cordis.europa.eu/project/id/806756)
- Project website: [bit.ly/APA-project](https://bit.ly/APA-project)

## INDUSTRIAL TECHNOLOGIES

# Innovative process-machine-tools solution for the manufacturing value chain

*An EU-funded project is changing the face of industrial production, paving the way for manufacturers to produce high-quality metallic components at reduced costs.*

Hybrid machines are expected to be the industrial solution for producing highly complex components. They can bring together multiple processes, such as laser metal deposition (LMD), in a single machine capable of carrying out the entire manufacturing process of such parts.

While many hybrid machines exist in the market, they lack maturity for the industry and further research is still needed for the development of their auxiliary elements, such as software solutions, monitoring and control. This

“ We aimed to make a quantitative and qualitative leap in laser-based AM technology for metallic components by increasing the reliability of the LMD process, its integration with subtractive processes, and by developing a set of tools and ad hoc technologies that facilitate the integration of LMD with consolidated conventional manufacturing methods. ”

presents key challenges for their commercialisation and adoption in the market.

Within this scope, the EU-funded project PARADDISE (A Productive, Affordable and Reliable solution for large scale manufacturing of metallic components by combining laser-based ADDitive and Subtractive processes with high Efficiency) set out to provide stakeholders in the manufacturing value chain with the knowledge, tools and components for hybrid manufacturing technology that brings together additive manufacturing (AM), known as LMD, and conventional machining – milling and turning – processes. “We aimed to make a quantitative and qualitative leap in laser-based AM technology for metallic components by increasing the reliability of the LMD process, its integration with subtractive processes, and by developing a set of tools and ad hoc technologies that facilitate the integration of LMD with consolidated conventional manufacturing methods,” explains Amaia Alberdi, project coordinator.

## TOWARDS A COMBINED MANUFACTURING PROCESS

To achieve the project’s goals, PARADDISE developed several tools that included a materials and process

database, computer-aided technologies, a monitoring control system for the layer height, and smart components such as a smart powder feeder and LMD head. This paved the way for the project’s 11 exploitable results. “One is a hybrid machine for LMD and machining, with integrated smart technologies as well as a monitoring system for a metal LMD process and an LMD materials and process database,” adds Alberdi. This database comprises 12 technical tables containing relevant information such as productivity, geometry and powder efficiency.

PARADDISE’s combined process solution was integrated into the IBARMIA ZVH45/1600 Add+Process hybrid machine. Alberdi notes: “This machine is a high-productivity five-axis machining centre, with fixed table and mobile column architecture. It has the capability of executing various manufacturing processes.”

The integration, along with two use cases, validated the solution. This gives manufacturers of value-added metallic components the opportunity to produce reliable, high-quality parts, using less material and fewer energy resources. This in turn will reduce manufacturing costs while increasing the solution’s scope for wider adoption in other market segments.

## WHAT THE FUTURE HOLDS

The project team will promote their solution to industrial partners and networks. They also plan to carry out an assessment of how well it integrates into other machining centres that have different architectures from the IBARMIA manufacturer. “This is to increase the target market, and to find new use cases to apply the hybrid concept.”

The results of PARADDISE are also expected to lead to job creation. “This will cover qualified profiles such as software engineers for the PARADDISE CAX technologies, design engineers for designing appropriate components and equipment, production engineers for supporting customised and on-demand manufacturing of complex parts, etc.,” concludes Alberdi. This is in addition to the jobs created from the PARADDISE Services Ecosystem that covers services along the life cycle of mechanical products of complex geometries.

## PARADDISE

- Coordinated by TECNALIA Research & Innovation in Spain
- Funded under Horizon 2020-LEIT-ICT
- [cordis.europa.eu/project/id/723440](https://cordis.europa.eu/project/id/723440)
- Project website: [paraddise.eu](https://paraddise.eu)
- ▶ [bit.ly/paraddise-video](https://bit.ly/paraddise-video)





# App assisting vision-impaired people now includes corporate customers

*Nobody likes corporate helplines, but they're worse for customers unable to see or describe their problem. Now, a global volunteering system makes corporate helplines accessible.*

The advent of mobile video calls has improved the help available to people living with visual impairments. Vision-impaired people can phone a sighted person, whom they ask to describe what can be seen through the phone camera. However, people with visual impairments end up regularly calling the same set of family or friends. This, they say, makes them feel like a burden.

In 2012, Danish company Be My Eyes introduced a prototype video assistance system for vision-impaired people. It allows them to enlist the help of volunteers for visual assistance. By 2016, the system had matured, and Be My Eyes had

been established in over 100 countries. Today, the system connects vision-impaired people in need of help with sighted people willing to volunteer for a few minutes.

## SEEKING CORPORATE INVOLVEMENT

Many large companies do not specifically cater to people with vision impairments. The Be My Eyes system was not previously supported at the corporate level. The EU-funded project BEMYEYES (Specialized Help from Be My Eyes – harnessing technology to connect companies



directly with their blind and visually impaired users) assisted the company of the same name to investigate the possibility of including large corporations.

The standard Be My Eyes system has, for several years, run as a mobile phone or tablet application. Users sign up as either a vision-impaired person or a volunteer. As of March 2021, the community included more than 290 000 vision-impaired people and 4.6 million volunteers in over 150 countries.

“The connection is made based on language and time zone,” explains project coordinator Christian Erfurt. “So if you’re in need of assistance in the middle of the night in Australia, for example, we’ll match you to an English-speaking, or whatever language you like, volunteer somewhere else in the world in a suitable time zone.” The connection is established within 15 seconds. Then the vision-impaired person asks for help with their problem, without having to bother family or friends at inconvenient times.

### CORPORATE SECTOR SAYS YES

One of the goals of the project’s feasibility study was to find ways to incorporate corporate helplines into the Be My Eyes system. In these cases, companies enlist dedicated staff who provide visual assistance specifically concerning the corporate matters vision-impaired people may need help with. “The vision-impaired person uses the Be My Eyes system to connect directly to a customer support centre,” adds Erfurt. “One of the company’s trained agents, knowledgeable about the company’s products or services, enters the private and secure call.

“*Researchers demonstrated to companies the financial benefits of working with BEMYEYES to improve services to the vision-impaired community.*”

With confidentiality agreements already in place, this allows personal data to be discussed openly.”

The answer to the project’s research question of whether companies wished to participate was a resounding yes. The system does not charge people with visual impairments, or volunteers, but does charge participating companies. Nevertheless, researchers demonstrated to companies the financial benefits of working with BEMYEYES to improve services to the vision-impaired community, who represent a large and hitherto neglected market. So far, Be My Eyes has signed up many of the world’s largest corporations, including Microsoft and Google.

Project team members will continue expanding the corporate branch of the Be My Eyes system. This provides another layer of support for people living with vision impairments.

### BEMYEYES

- Coordinated by Be My Eyes in Denmark
- Funded under Horizon 2020-SME, Horizon 2020-LEIT and Horizon 2020-Societal Challenges
- [cordis.europa.eu/project/id/873373](https://cordis.europa.eu/project/id/873373)
- Project website: [bemyeyes.com/specialized-help](https://bemyeyes.com/specialized-help)

### DIGITAL ECONOMY

# Realatars will soon be making their way to our screens

*EU researchers are paving the way for cost-effective sign language programmes for TV broadcasting.*

Ensuring that those in the deaf community have access to information, communication and knowledge is vital for their full and equal participation in society. The Audiovisual Media Services Directive aims to ensure that

EU Member States make certain that media services contribute to equality and accessibility regarding content distribution and accessibility. However, producing sign language content is costly, with many companies offering

“*The innovative nature of this concept was awarded the prestigious NAB Technology Innovation Award at the Broadcast Engineering and Information Technology Conference in 2020.*”

only a small number of sign-presented programmes that are usually aired late at night.

The EU-funded Content4All (Personalised Content Creation for the Deaf Community in a Connected Digital Single Market) project set out to change this and make content more accessible for the deaf community through an automatic sign translation workflow with a photorealistic 3D human avatar for TV broadcasting. “We had two main goals. The first was providing a low-cost solution to create sign-interpreted versions of content produced for hearing audiences, without impacting on the viewing experience of current users. The second was to create data sets and algorithms to explore automated sign-interpreted content creation,” notes Giacomo Inches, project coordinator and innovation technologist at Fincons Group.

### MEET REALATAR, THE AVATAR

The avatar is achieved through an innovative multicamera studio where the movements of real people are captured and then processed with the help of AI algorithms. The end result is a 3D photorealistic avatar, named realatar, that can be distributed through video stream.

Inches further explains: “While automatic sign language generation was a technological exploration in the lab, not meant for the market, we looked at the new concept, ‘remote studio’ for broadcasters, in which sign language interpreters could perform their job without needing to travel to the main premise of the broadcaster.” The time saved could then be employed to generate more signed content.

The technologies used in the project relied on advanced deep learning and machine learning algorithms. They enable a computer to observe a large amount of data, and from instructions via examples they provide a desired outcome. “In the project, the algorithms helped reproduce a real person as a virtual human in real time, on a dedicated HbbTV app,” adds Inches. This solution gives TV broadcasters an affordable and sustainable way of developing sign language programmes, ultimately opening the door to increased production.



### MOVING FORWARD WITH NOTABLE ACHIEVEMENTS

“The innovative nature of this concept was awarded the prestigious NAB Technology Innovation Award at the Broadcast Engineering and Information Technology Conference in 2020,” says Inches. Additionally, with the help of their partner representative organisations, the project was able to engage with members from the deaf community in Belgium and Switzerland to validate the technological components. Discussions from this enabled the project to launch an initiative under the umbrella of the COST Action, LEAD-ME, that brings together European stakeholders in the field of media accessibility.

Two other projects, EASIER and SignON, will exploit and extend the Content4All project legacy, directly employing the signed collection. Furthermore, the Fincons Group, coordinator and lead industrial partner, is exploring concrete ways to exploit the project results for their network. Inches concludes: “In the long term, a concrete outcome of the project would be the employment of the collection of text aligned with sign language videos for research and pre-commercial purposes, and therefore contribute to the future developments of all the algorithms for sign language recognition.”

### CONTENT4ALL

- Coordinated by Fincons Group in Switzerland
- Funded under Horizon 2020-LEIT-ICT
- [cordis.europa.eu/project/id/762021](https://cordis.europa.eu/project/id/762021)
- Project website: [content4all-project.eu](https://content4all-project.eu)
- ▶ [bit.ly/Content4All-video](https://bit.ly/Content4All-video)



## SECURITY

# Community-based policing critical to post-conflict countries

*Good police-community relations enhance the security of everyone, but this can be difficult to achieve in many post-conflict countries. Strengthening police accountability and thinking beyond surveillance are some of the ways that this challenge can be addressed.*

In many post-conflict countries, maintaining order is perceived to be the top policing priority. Threats of continued violence can lead to heavy-handed strategies, with a focus on fighting militants.

As a result, the police are seen as more of a force than a service.

“Such policing has weak links with local communities,” explains ICT4COP (Community-Based Policing and Post-Conflict Police Reform) project coordinator Ingrid Nyborg, associate professor at the Norwegian University of Life Sciences. “This leads to serious deficits of trust. We felt that a new focus was needed.”

### COMMUNITY-ORIENTED POLICING

The ICT4COP project was launched to look at how community-oriented policing (COP) in post-conflict settings could be strengthened. COP strategies seek to develop and maintain police relationships with community members, rather than impose top-down control.

Researchers focused on 12 post-conflict countries across Latin America, south-eastern Europe, Africa and south Asia. Each situation was examined independently, to identify common challenges to achieving COP and to come up with recommendations.

In all the cases studied, a variety of security providers was present. “While it is often assumed that a state operates as a monopoly on providing security, this is rarely the case,” says Nyborg. “State security providers may in fact be perceived as sources of insecurity.”

Non-state security providers can include rebel organisations, criminal networks and private security companies. Local initiatives need to reflect these local realities.

Another key finding was that community-police relations vary greatly across the different geographical regions. This means that COP, despite a common vision, will inevitably look different in Somalia than it does in Pakistan.

In terms of technology, the research found that the use of ICT does not automatically build trust or improve community-police relations. Where there is distrust of the police, citizens are unlikely to welcome ICT tools introduced by the police. There is a need to think beyond ICT as a tool for surveillance or crime reporting.

Finally, the research found a need to focus more on gender issues in COP, and a tendency among police to assume that young people are engaging in criminal activity.

### BUILDING MUTUAL TRUST

Though the researchers recorded limited progress, their findings underscore the importance of COP as a means of improving police-community relations, and of strengthening citizen security. A critical element in all of this is the need to build mutual trust. “Accountability needs to come not only from the community, but also from the police,” notes Nyborg.

Furthermore, while international guidance can help, COP cannot be perceived as foreign or external. Local police forces need to buy into the concept of COP themselves, and forge meaningful cooperation with local communities. “This is as much about police behaviour and culture as technical skills,” adds Nyborg.

To help turn these findings into reality, the project team has delivered a range of resources for police forces and communities. These include an e-handbook on the key issues surrounding COP, as well as an e-learning course for international police advisors.



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A Police Experts Network that was established will continue to act as a forum for police, academics and civil society, to enable them to come together and learn from each other.

“We have also received requests for collaboration from international and national police institutions and civil society actors and we will continue to interact as a network, and work towards COP that is reflective, participatory and co-created with civil society.”

#### ICT4COP

- Coordinated by the Norwegian University of Life Sciences in Norway
- Funded under Horizon 2020-SECURITY
- [cordis.europa.eu/project/id/653909](https://cordis.europa.eu/project/id/653909)
- Project website: [communitypolicing.eu](https://communitypolicing.eu)
- ▶ [bit.ly/ICT4COP-videos](https://bit.ly/ICT4COP-videos)

#### SECURITY

# Harnessing collective intelligence to find missing children

*Whether runaways or unaccompanied migrants, all missing children are vulnerable. ChildRescue has developed a smart solution which activates citizens as social sensors to help trace them.*

It is estimated that over 250 000 children go missing every year in the EU. Statistics on their recovery are scant, but based on data from the EU-wide 116 000 hotline, 14% of runaways and 57% of migrant minors reported missing in 2019 had not been found by the end of the year.

The EU-supported ChildRescue (Collective Awareness Platform for Missing Children Investigation and Rescue)

project has developed a collective intelligence and stakeholder communication approach for missing children investigations. It consists of a collaborative platform and two mobile apps available for organisations, verified volunteers and the general public.

“ChildRescue is being used by our piloting organisations and is already becoming instrumental in missing children investigations. The public response has exceeded our



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expectations, with over 22 000 app downloads,” says project coordinator Christos Ntanos from the Decision Support Systems Laboratory at the National Technical University of Athens.

ChildRescue has also published a white paper on the need for a comprehensive legal framework on missing unaccompanied migrant minors in the EU.

### CITIZENS AS SOCIAL SENSORS

To assist in missing children investigations, ChildRescue trained machine learning algorithms to find underlying patterns useful for investigations. As input, they used structured information about individual cases combined with open data from multiple sources, alongside data from similar past cases.

The ChildRescue community mobile app issues real-time alerts near places of interest, such as where a child was last seen. Citizens can respond with information, including photos, exclusively accessible by the organisation involved in the case. The quality, relevance and credibility of this feedback are assessed by an algorithm.

The organisation can then pass information to the police and engage its own volunteers. Team members can share real-time information through a dedicated private collaboration space.

“Correct handling of sensitive data about children in distress is vital. Our solution is fully compliant with the GDPR, users’ access rights are role-dependent and personal data are encrypted. At the end of each investigation, all case data are automatically deleted from mobile devices,” explains Ntanos. “ChildRescue’s methodology and processes were continuously monitored by an independent Ethics Advisory Board.”

Piloting consisted firstly of simulation exercises at the premises of each pilot organisation – Smile of the Child, Child Focus and the Hellenic Red Cross, resulting in feedback for the technical teams.

Field-testing in Greece and Belgium used scenarios from anonymised actual cases. As well as involving the organisational teams, this included technical partners from SingularLogic, UBITECH and Suite5, supported by Frankfurt University of Applied Sciences, Missing Children Europe and MADE – all working online, in adherence to COVID-19 restrictions.

### EARLY IMPACT

The web platform was released in Greece and Belgium, along with the two mobile apps, one for the general public (Android and iOS) and another for verified volunteers (Android only). The open-source code is hosted in GitHub and GitLab.

“ChildRescue has already been used in over 40 cases by Child Focus in Belgium, in over 30 cases by Smile of the Child in Greece, while the Hellenic Red Cross has been using it to support 19 unaccompanied migrant minors. Being able to ease the suffering of families and children in distress is our greatest achievement, but we are equally proud to have raised public awareness about this significant humanitarian issue,” concludes Ntanos.

The project’s next step is to expand its adoption to additional organisations, and to ensure its long-lasting operational and financial sustainability.

### CHILDRSCUE

- Coordinated by the National Technical University of Athens in Greece
- Funded under Horizon 2020-LEIT-ICT
- [cordis.europa.eu/project/id/780938](https://cordis.europa.eu/project/id/780938)
- Project website: [childrescue.eu](https://childrescue.eu)



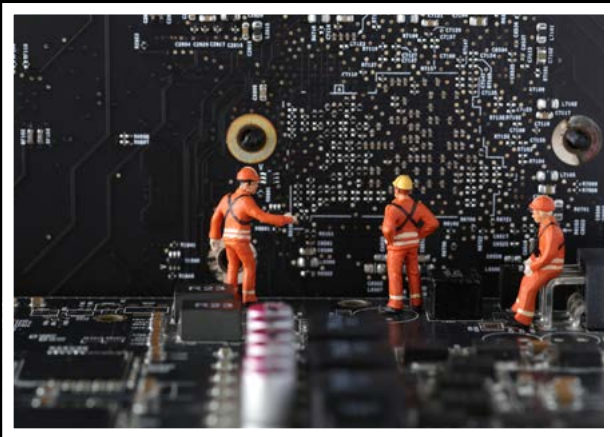
Over **250 000 children** go missing every year in the EU





# Exploring how social media and crowdsourcing can contribute to more disaster-resilient societies

*This month, we highlight the LINKS project which has just reached its 1-year milestone. Amongst its top achievements have been three comprehensive studies across three core knowledge domains focusing on the social, institutional and technical dimensions of the role of social media and crowdsourcing during disasters. The findings from these studies, freely available, will be applied in the project's upcoming fieldwork, due to begin in November 2021.*



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“ Social media and crowdsourcing offer many opportunities for engaging with, and giving voices to, different stakeholders within a community which can support disaster risk management efforts and ultimately create more resilient societies. But at the same time there are still risks, challenges and unknowns associated with these technologies and processes which can just as easily compromise resilience. ”

Nathan Clark, LINKS project coordinator

Over the past year LINKS (Strengthening links between technologies and society for European disaster resilience) has taken up the challenge of digging deeper into the opportunities and challenges social media and crowdsourcing (SMCS) present in disaster settings. Despite the pandemic, the project has still been able to collaborate virtually across six European countries and 15 partner organisations to set the conceptual and methodological foundations for the upcoming field research.

Together with local partners, LINKS will soon begin conducting studies across five diverse case scenarios including: flooding in Denmark, droughts and terrorism in Germany, earthquakes in Italy and industrial hazards in the Netherlands, to better understand the role of SMCS for local communities in disasters.

Ultimately, all these studies will contribute to the LINKS Framework, a set of learning materials on the uses of SMCS in disasters for a wide variety of stakeholders, including practitioners, policymakers and local communities. It will be accessible to everyone through the LINKS Community Center (LCC), currently being designed as an interactive web-based platform.

The project is interested in engaging with the broader crisis management community through the LCC and other project activities. To find out more about the project or about how to join the LINKS Community, please go to: [links-project.eu](https://links-project.eu)

- Coordinated by VU Amsterdam in the Netherlands
- Funded under Horizon 2020-SECURITY
- [cordis.europa.eu/project/id/883490](https://cordis.europa.eu/project/id/883490)

If you are interested in having your project featured in 'Project of the Month' in an upcoming issue, please send us an email to [cordis.europa.eu](mailto:cordis.europa.eu) and tell us why!



# ‘Transmogrifying’ mirrors created with nanoscale patterning

*Arrays of tiny rectangular blocks can turn ordinary materials into metasurfaces, allowing scientists to precisely control how light interacts with the object.*

In the last 30 years, photonics has witnessed important technological developments, becoming central to applications in navigation, remote sensing and communications. However, manipulating light typically requires the use of optical lenses which can be bulky, heavy and fragile.

The EU-funded FLATLIGHT (Functional 2D metamaterials at visible wavelengths) project supports the further miniaturisation of optics and optoelectronics by using an alternative system to guide and shape light. “What we’re doing is conceiving optical devices that replicate bulky optical lenses and prisms using nanostructured interfaces,” explains project coordinator Patrice Genevet.

## LIGHT CONTROL

His team at Côte d’Azur University’s Research Center for Heteroepitaxy and its Applications (CRHEA) constructed interfaces just 1 micron thick, containing arrays of nanoscale rectangular blocks of tightly controlled size, shape and spacing.

“These components shape light by changing the electromagnetic field properties, i.e. amplitude phase, polarisation and frequency, across material thinner than 100th the diameter of a human hair,” says Genevet.



“The goal of FLATLIGHT is to fabricate metasurfaces operating in the visible wavelength range using nanostructured semiconductor materials that control light emission, transmission and reflection at the interface.”

For example, certain nanostructures can bend light in an arbitrary direction as it passes through the interface. By precisely varying the pattern across the surface, light passing at the edges can be bent more than in the centre, focusing the beam.

“These are metasurfaces, i.e. surfaces with functionalities that extend beyond classic interfaces,” adds Genevet. “Metasurface light-addressing capabilities are unique, you are not able to find similar effects in other optical devices.”

One application is in vertical-cavity surface-emitting lasers (VCSELs) – tiny electronic components used to emit high-frequency, low-power laser light. These are central to applications such as the LIDAR needed for smartphone face recognition.

By patterning the surface of the laser diode, Genevet and his team demonstrated that the emitted light could be shaped as desired, reducing divergence and removing the need for an additional collimation lens.

## CLOAKING DEVICES

The nanostructures can also improve on traditional optical lenses, which suffer from inherent shortcomings known as aberrations. For example, chromatic aberration occurs as different colours of light are refracted at different magnitudes, giving the resulting image rainbow fringes. Etching nanostructures on the surface of the lens could compensate for that.

The technology can also be used to make LEDs with more advanced properties such as polarisation and directional lighting, offering the potential to create compact holographic displays. “Another interesting application is cloaking,” says Genevet.

“*It would be a new type of cloaking interface, capable of turning one thing into something else.*”

“Imagine wrapping an interface around an object and reflecting the image of something else. It would be a new type of cloaking interface, capable of turning one thing into something else, bringing Harry Potter’s transmogrifying spell to reality.”

The work was supported by the European Research Council. “It’s very clear that without ERC support, nothing would have happened,” notes Genevet. “It was an amazing opportunity to establish my programme, develop all of the related nanofabrication recipes, all of the conception programmes, and establish the optical characterisation lab.”

Next, Genevet plans to apply for a Consolidator Grant to continue his research. “We have come up with amazing new ideas, and now we have a clear vision of what is possible and what is not.”

His lab also received ERC proof of concept funding to develop a compact high-frequency LIDAR system using metasurfaces. They are now aiming to build a more comprehensive prototype with a view to commercialising this technology.

## FLATLIGHT

- Hosted by the National Centre for Scientific Research in France
- Funded under Horizon 2020-ERC
- [cordis.europa.eu/project/id/639109](https://cordis.europa.eu/project/id/639109)
- Project website: [bit.ly/3wKje0g](https://bit.ly/3wKje0g)

# Building functional chromosomes to characterise chromatin replication

*Despite the hope epigenetics offers for better medical treatments, its underlying molecular processes remain largely uncharacterised. CHROMOREP is working to create functional chromosomes that will reveal how DNA replication interacts with gene expression.*

If genetics is about the inheritance of DNA sequences, epigenetics is about how the expression of these sequences is inherited during cell division. These ‘expression patterns’ of genes help explain inherited traits.

Key to epigenetics is chromosome replication which involves the accurate copying of DNA sequences, along with the duplication of all the factors which package the DNA and regulate its expression. Yet the precise molecular mechanisms underpinning these copying processes are still largely uncharacterised.

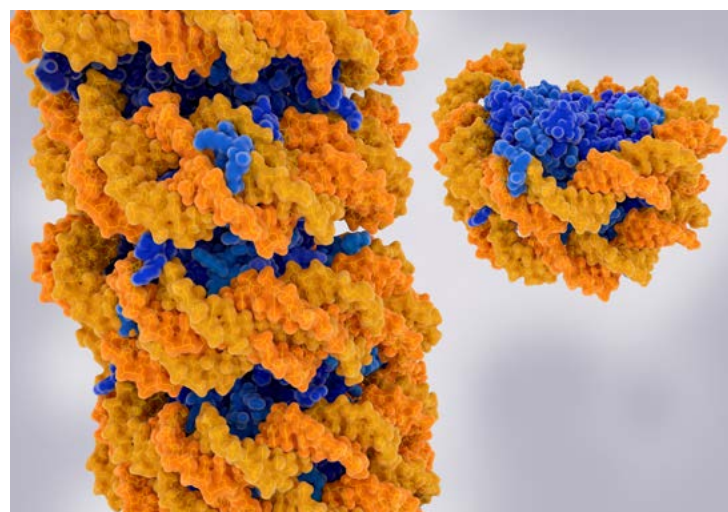
Drawing on the team’s previous success in reconstituting eukaryotic DNA replication using yeast, the EU-supported CHROMOREP (Reconstitution of Chromosome Replication and Epigenetic Inheritance) project further explored chromosome replication using purified proteins for the first time.

“Our approach offers the tool, previously missing, to study epigenetics and learn more about how chromatin influences the initiation sites and timing of replication,” explains project coordinator John Diffley from the Francis Crick Institute, the project host.

## EPIGENETIC INHERITANCE

On a cellular level, one of the most important aspects of epigenetics is the inheritance of ‘gene expression states’. Two cells might have identical DNA sequences, but one, such as a blood cell, will express different genes to a skin cell.

While many genetic expressions are dynamic, re-established in each cell cycle by transcription factors, some remain stable over many generations, a phenomenon known as ‘epigenetic inheritance’.



In epigenetic inheritance, histone proteins, bound to DNA to form packages called nucleosomes, are disrupted during DNA replication. The histones, along with any chemical modifications, are then redeposited at the same position on the DNA molecules of the ‘daughter’ strands (chromatids) of DNA. These are created after the double helix is separated into two single strands and each strand copied. The resulting chromatids then re-establish gene expression patterns.

## REVEALING THE PRECISE MECHANISMS OF CHROMOSOME REPLICATION

The CHROMOREP team expressed and purified all the proteins required for chromosome replication, on naked DNA, and reconstituted them using their chromatin templates. They were able to combine roughly 30 purified proteins to replicate chromatin.

“Our approach offers the tool, previously missing, to study epigenetics and learn more about how chromatin influences the initiation sites and timing of replication.”

“The complete chromatin replication reactions are extraordinarily complex given the number of moving parts. Purifying and using 30 different proteins is very high-end biochemistry,” says Diffley.

The complete replisome, along with a histone chaperone protein known as FACT, were found to be sufficient for the team to achieve chromosome replication. This was evidenced by the redepositing of the histones on the daughter chromatids.

Replisomes are the molecular machinery responsible for DNA replication. Histone chaperones are proteins which bind to the histones providing a vehicle for the histones’ journey.

“As histones are highly positively charged and DNA is highly negatively charged, their interactions need to be ‘chaperoned’ to ensure that they occur in the right place, at the right time,” Diffley adds.

By further revealing the mechanisms of chromosome replication, the team anticipate being able to reconstitute genome-wide replication patterns and also to go beyond yeast systems and work with human proteins.

“Our work helps explain epigenetic inheritance at a molecular level, complementing work done by others in entire living organisms. Crucially, by actually building functional chromosomes, we can understand how problems occur and lead to diseases, like cancer,” says Diffley.

#### CHROMOREP

- Hosted by the Francis Crick Institute in the United Kingdom
- Funded under Horizon 2020-ERC
- [cordis.europa.eu/project/id/669424](https://cordis.europa.eu/project/id/669424)

### FUNDAMENTAL RESEARCH

# The secret love life of fruit flies

*There’s a lot we can learn from the differences between male and female fruit flies’ brains – and the impact these have on their mating behaviour.*

How do differences in behaviour between the sexes relate to the specific ways in which our brains are wired? When it comes to humans, there is no straightforward answer to this question yet, but studying the brains of fruit flies could provide new insights.

A team of researchers has been able to pinpoint hardwired differences between the brains of male and female flies, which could point to similar distinctions in other species.

With around 100,000 neurons – compared to an estimated 86 billion in humans – the brain of *Drosophila*, the common fruit fly, is a relatively simple system. At the same time, the complex behaviours these flies display during courtship and mating make their brains important models for studying the functioning of neural circuits.

The sexual dimorphism (Sexually dimorphic neuronal circuits underlying social behaviours in *Drosophila*) project, undertaken with the support of the Marie Skłodowska-Curie Actions programme, focused on the male fly’s pheromone to study the different responses elicited in male and female brains and the behavioural reactions they triggered.

#### OPPOSITE BEHAVIOURS

“The male pheromone is attractive to females and promotes mating behaviour, but it is repulsive to other males and promotes aggression,” explains Dana Shani Galili, Marie Skłodowska-Curie fellow, who led the research in this project at the MRC Laboratory of Molecular Biology.

What happens in the flies’ brains during a close encounter? To find out, the researchers looked at the neural pathways



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connecting the different parts of the nervous system. They examined which role they play in processing the pheromone, which elements are differentiated between sexes, and how they regulate sexual behaviours.

In both sexes, the male pheromone elicits a strong response, activating the same subset of neurons but triggering opposite behaviours. This suggests that in both sexes, these identical neurons connect with sex-specific neurons which in turn regulate their mating behaviour.

The team discovered a second pathway which appears to act as a channel for decreasing the sex drive in males. In females, it enables a more fine-tuned response, where neurons in the same circuit work together to combine information on the taste and smell of surrounding stimuli. "Multisensory integration allows for a more robust read-out," Galili notes.

### MAPPING THE BRAIN

The connections highlighted thanks to the project offer a new understanding of how nerve signals are processed and impact decision-making and behaviour.

"The neuroanatomical map we uncovered spans from sensory neurons detecting smell, taste, touch etc., to neurons controlling motor output. We can now clearly

*“ We can now clearly detect sex-specific patterns of connectivity, and causally relate them to behaviour. ”*

detect sex-specific patterns of connectivity, and causally relate them to behaviour," she says.

These findings could help us explain social behaviours in other species as well. Previous research found common characteristics in the neural circuits of flies and mice, which could indicate that behaviours such as mating and fighting are controlled by the brain through a common network.

So what about us humans? "While the degree of connectivity differences between the brains of men and women and the potential causes and effects of these distinctions are not yet known, emerging evidence suggests that human pheromones exist and elicit a sex-specific response," Galili notes.

By establishing a causal relationship between sex-specific wiring and behaviour, the findings on fruit flies could inform future research in this area.

### SEXUAL DIMORPHISM

- Coordinated by United Kingdom Research and Innovation in the United Kingdom
- Funded under Horizon 2020-MSCA-IF
- [cordis.europa.eu/project/id/748478](https://cordis.europa.eu/project/id/748478)
- Project website: [bit.ly/sexual\\_dimorphism](https://bit.ly/sexual_dimorphism)



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## AGENDA

# NOVEMBER 2021

**GLASGOW, UK, BRUSSELS, BELGIUM & ONLINE**  
COP26 Climate Change Conference  
→ [bit.ly/COP26-conference](https://bit.ly/COP26-conference)

**1 → 12  
NOV**

**3 → 4  
NOV**

**BRUSSELS, BELGIUM**  
EU-ToxRisk Final Open Symposium  
→ [bit.ly/EU-ToxRisk\\_symposium](https://bit.ly/EU-ToxRisk_symposium)

**13  
NOV**

**INTERNATIONAL**  
World Antibiotic Awareness Week

**15  
NOV**

**ONLINE**  
DG ECFIN Annual Research Conference  
→ [bit.ly/ECFIN-annual-research-conference](https://bit.ly/ECFIN-annual-research-conference)

**17 → 18  
NOV**

**BRUSSELS, BELGIUM & ONLINE**  
European Cancer Summit 2021  
→ [europeancancer.org/summit](https://europeancancer.org/summit)

**18  
NOV**

**INTERNATIONAL**  
World Philosophy Day

**15-19  
NOV**

**BRUSSELS, BELGIUM & ONLINE**  
EU Raw Materials Week

This sixth edition of the 'Raw Materials Week' will take place as a hybrid and online event, gathering a wide range of stakeholders in the field of raw materials. The 2021 Raw Materials Week will be centred around the eighth annual High-level Conference of the European Innovation Partnership (EIP) on raw materials and several complementary events addressing the latest news on raw materials in the EU, including: Critical Raw Materials, Trends in innovation and Skills for raw materials, EU Horizon technology success stories, EU-Canada Partnership, UNECE Resource management

→ [eurawmaterialsweek.eu/2021](https://eurawmaterialsweek.eu/2021)

Whilst at the time of writing all of these events were scheduled to take place, we advise all of our readers to regularly check the status of each event due to the continued uncertainty caused by the novel coronavirus epidemic in Europe – events may be cancelled, rescheduled or reformulated (e.g. switched to being a digital event only) at any time.

# RESULTS PACK ON PLANT HEALTH – NEW EDITION

This new edition of the CORDIS Results Pack on Plant Health features 12 EU-funded projects at the forefront of research and innovation activities addressing the sustainable protection of plants.



Check out the Pack here:  
[cordis.europa.eu/article/id/429972](https://cordis.europa.eu/article/id/429972)



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