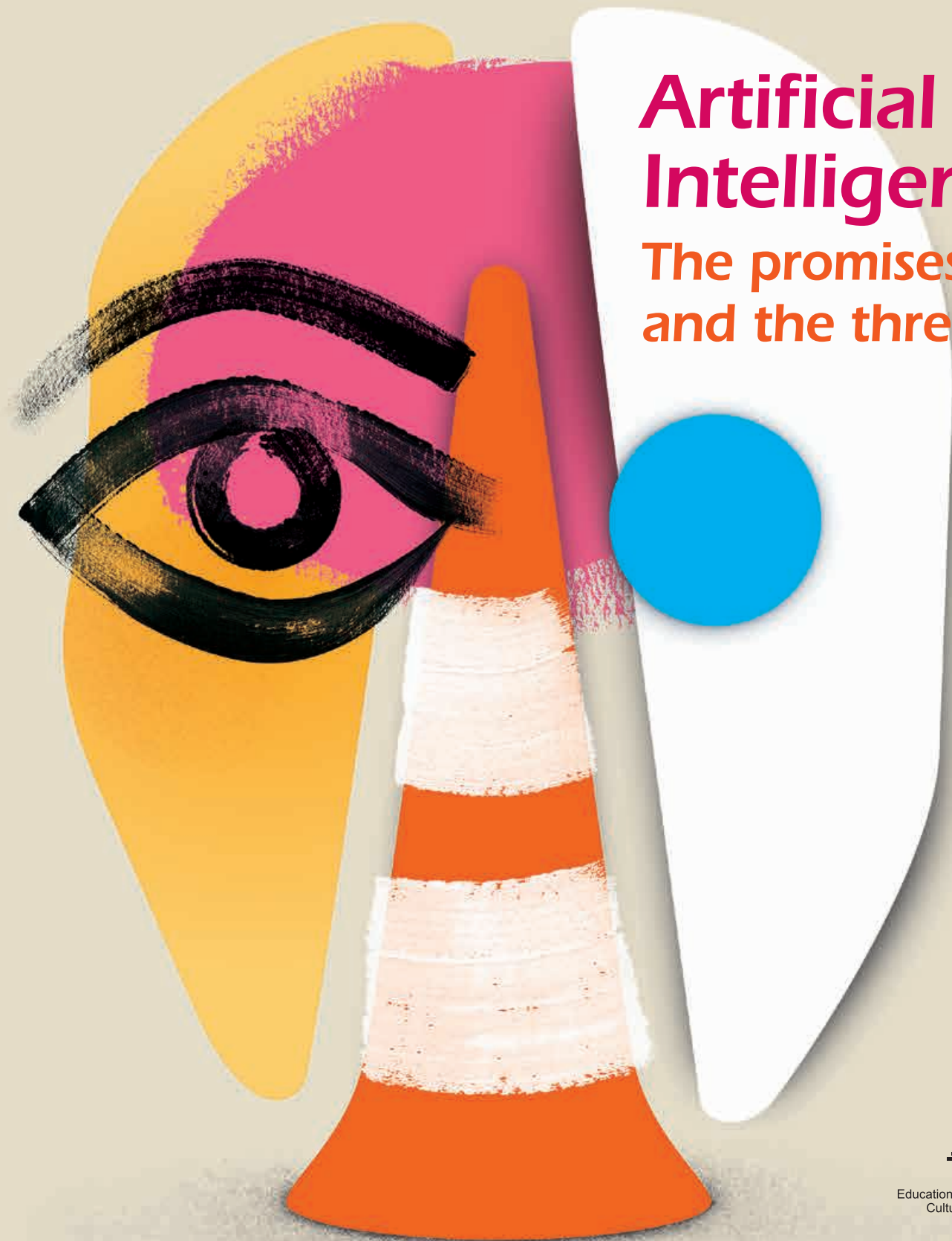


THE UNESCO Courier

July-September 2018

Artificial Intelligence

The promises
and the threats



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Towards a global code of ethics for artificial intelligence research

There have been spectacular advances in the field of artificial intelligence (AI) in recent years, leading to inventions that we had never thought possible. Computers and robots now have the capacity to learn how to improve their own work, and even make decisions – this is done through an algorithm, of course, and without individual consciousness. All the same, we must not fail to ask some questions. Can a machine think?

What is an AI capable of at this stage of its evolution? To what degree is it autonomous? Where does that leave human decision-making?

More than ushering in a Fourth Industrial Revolution, AI is provoking a cultural revolution. It is undeniably destined to transform our future, but we don't know exactly how, yet. This is why it inspires both fascination and fear.

In this issue, the *Courier* presents its investigation to the reader, elaborating on several aspects of this cutting-edge technology at the frontiers of computer science, engineering and philosophy. It sets the record straight on a number of points along the way. Because, let's be clear – as things stand, the AI cannot think.

And we are very far from being able to download all the components of a human being into a computer! A robot obeys a set of routines that allows it to interact with us humans, but outside the very precise framework within which it is supposed to interact, it cannot forge a genuine social relationship.

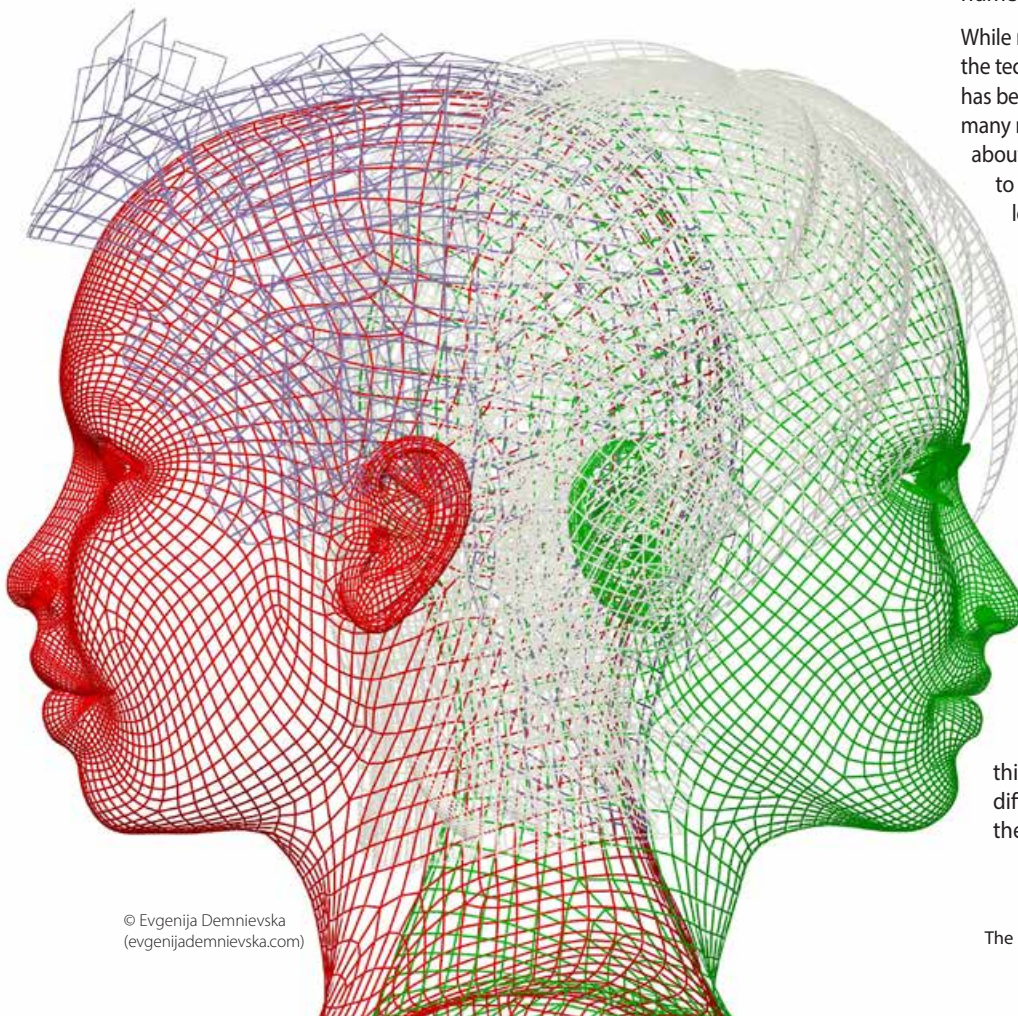
Even so, some of AI's applications are already questionable – data collection that intrudes on privacy, facial recognition algorithms that are supposed to identify hostile behaviour or are imbued with racial prejudice, military drones and autonomous lethal weapons, etc. The ethical problems that AI raises – and will undoubtedly continue to raise tomorrow, with greater gravity – are numerous.

While research is moving full speed ahead on the technical side of AI, not much headway has been made on the ethical front. Though many researchers have expressed concern about this, and some countries are starting to give it serious thought, there is no legal framework to guide future research on ethics on a global scale.

“It is our responsibility to lead a universal and enlightened debate in order to enter this new era with our eyes wide open, without sacrificing our values, and to make it possible to establish a common global foundation of ethical principles,” says Director-General Audrey Azoulay, of UNESCO's role, in this issue of the *Courier* (see pp. 37-39).

An international regulatory instrument is essential for the responsible development of AI, a task that UNESCO is in the process of undertaking. The *Courier* lends this initiative its support, by exploring different avenues of thought on the subject.

*Digital work by the artist
Evgenija Demnievska, representing
Janus, the Roman god with two faces:
one looking at the past, the other at the
future. He presides over all transitions,
from one state to another.*

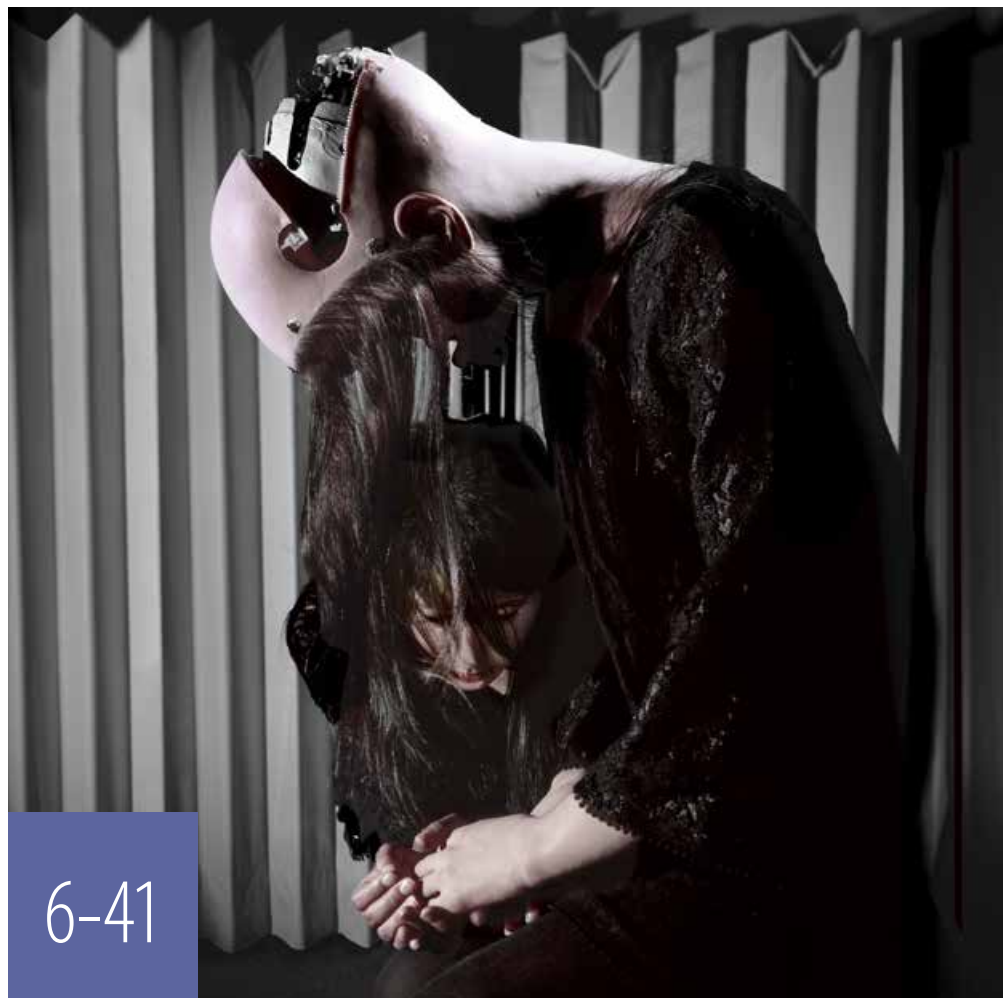


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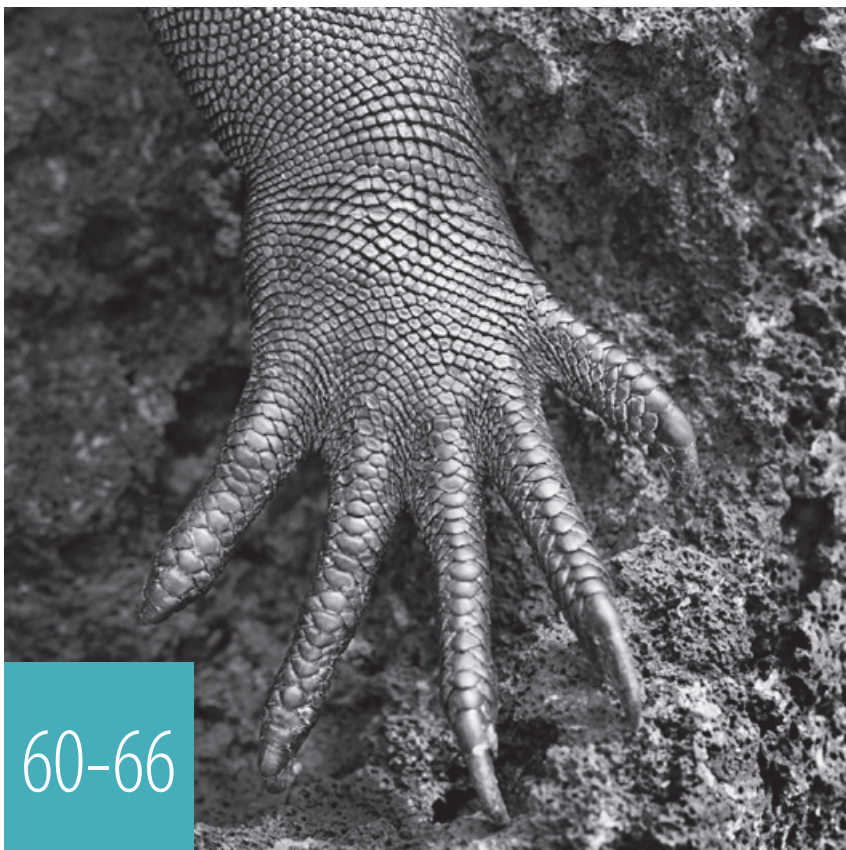


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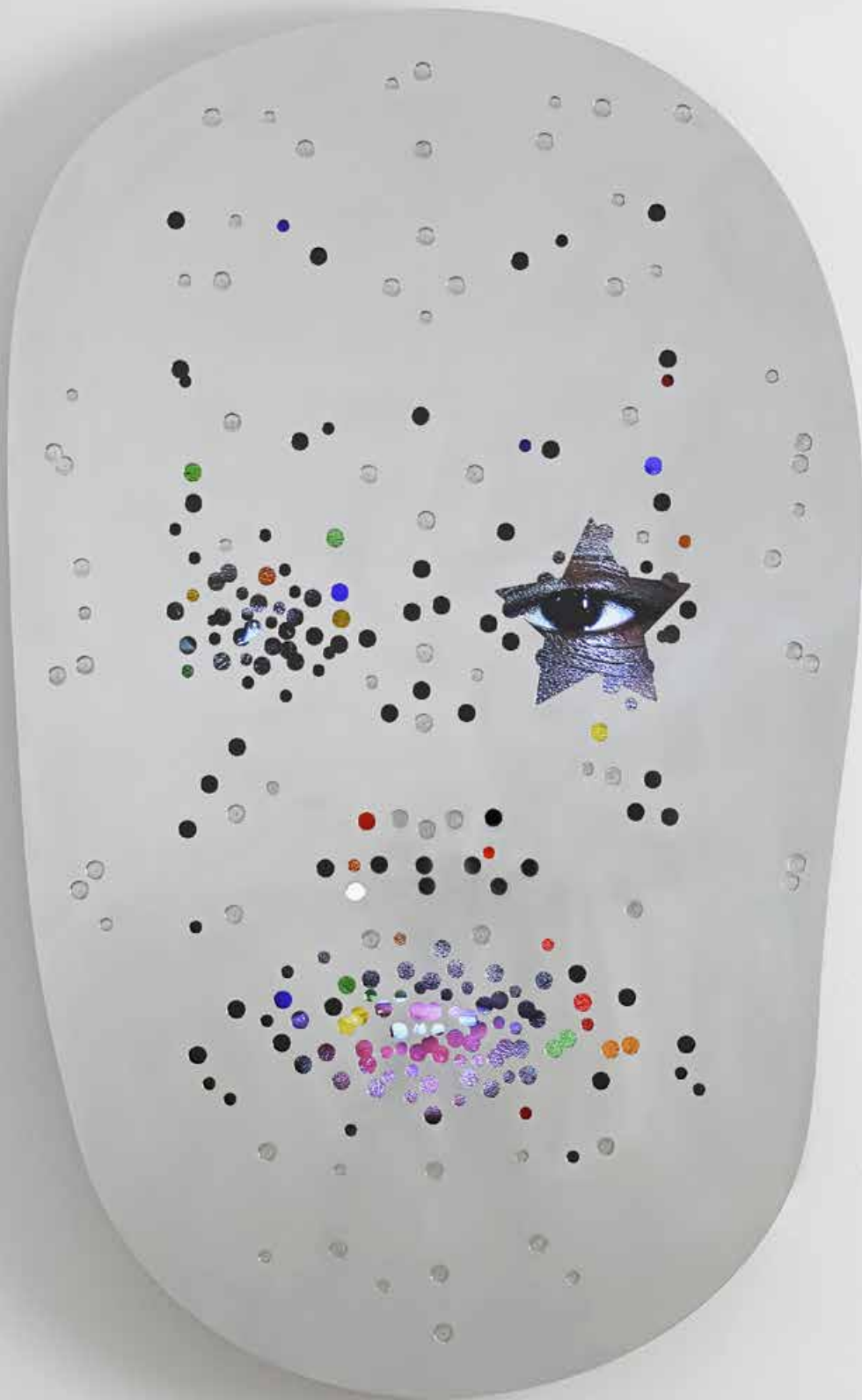
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**The Courier: The only journal
Nelson Mandela read on Robben Island!**
Annar Cassam



The promises and the threats

Wide angle



Facial recognition, *according to*
American artist Tony Oursler.

© Courtesy of the artist and Lehmann Maupin,
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Artificial intelligence: between myth and reality

Jean-Gabriel Ganascia

Are machines likely to become smarter than humans? No, says Jean-Gabriel Ganascia: this is a myth inspired by science fiction. The computer scientist walks us through the major milestones in artificial intelligence (AI), reviews the most recent technical advances, and discusses the ethical questions that require increasingly urgent answers.

A scientific discipline, AI officially began in 1956, during a summer workshop organized by four American researchers – John McCarthy, Marvin Minsky, Nathaniel Rochester and Claude Shannon – at Dartmouth College in New Hampshire, United States. Since then, the term “artificial intelligence”, probably first coined to create a striking impact, has become so popular that today everyone has heard of it. This application of computer science has continued to expand over the years, and the technologies it has spawned have contributed greatly to changing the world over the past sixty years.

However, the success of the term AI is sometimes based on a misunderstanding, when it is used to refer to an artificial entity endowed with intelligence and which, as a result, would compete with human beings.

This idea, which refers to ancient myths and legends, like that of the golem [from Jewish folklore, an image endowed with life], have recently been revived by contemporary personalities including the British physicist Stephen Hawking (1942-2018), American entrepreneur Elon Musk, American futurist Ray Kurzweil, and proponents of what we now call Strong AI or Artificial General Intelligence (AGI). We will not discuss this second meaning here, because at least for now, it can only be ascribed to a fertile imagination, inspired more by science fiction than by any tangible scientific reality confirmed by experiments and empirical observations.

For McCarthy, Minsky, and the other researchers of the Dartmouth Summer Research Project on Artificial Intelligence, AI was initially intended to simulate each of the different faculties of intelligence – human, animal, plant, social or phylogenetic – using machines.

CB2, an infant robot, was built by Minoru Asada, Japan, who wanted to understand how robots learn. Here, CB2 is being taught to crawl.

More precisely, this scientific discipline was based on the conjecture that all cognitive functions – especially learning, reasoning, computation, perception, memorization, and even scientific discovery or artistic creativity – can be described with such precision that it would be possible to programme a computer to reproduce them. In the more than sixty years that AI has existed, there has been nothing to disprove or irrefutably prove this conjecture, which remains both open and full of potential.

Uneven progress

In the course of its short existence, AI has undergone many changes. These can be summarized in six stages.

The time of the prophets

First of all, in the euphoria of AI's origins and early successes, the researchers had given free range to their imagination, indulging in certain reckless pronouncements for which they were heavily criticized later.

© Max Aguilera-Hellweg / INSTITUTE





For instance, in 1958, American political scientist and economist Herbert A. Simon – who received the Nobel Prize in Economic Sciences in 1978 – had declared that, within ten years, machines would become world chess champions if they were not barred from international competitions.

The dark years

By the mid-1960s, progress seemed to be slow in coming. A 10-year-old child beat a computer at a chess game in 1965, and a report commissioned by the US Senate in 1966 described the intrinsic limitations of machine translation. AI got bad press for about a decade.

Semantic AI

The work went on nevertheless, but the research was given new direction. It focused on the psychology of memory and the mechanisms of understanding – with attempts to simulate these on computers – and on the role of knowledge in reasoning. This gave rise to techniques for the semantic representation of knowledge, which developed considerably in the mid-1970s, and also led to the development of expert systems, so called because they use the knowledge of skilled specialists to reproduce their thought processes. Expert systems raised enormous hopes in the early 1980s with a whole range of applications, including medical diagnosis.

Neo-connectionism and machine learning

Technical improvements led to the development of machine learning algorithms, which allowed computers to accumulate knowledge and to automatically reprogramme themselves, using their own experiences.

This led to the development of industrial applications (fingerprint identification, speech recognition, etc.), where techniques from AI, computer science, artificial life and other disciplines were combined to produce hybrid systems.

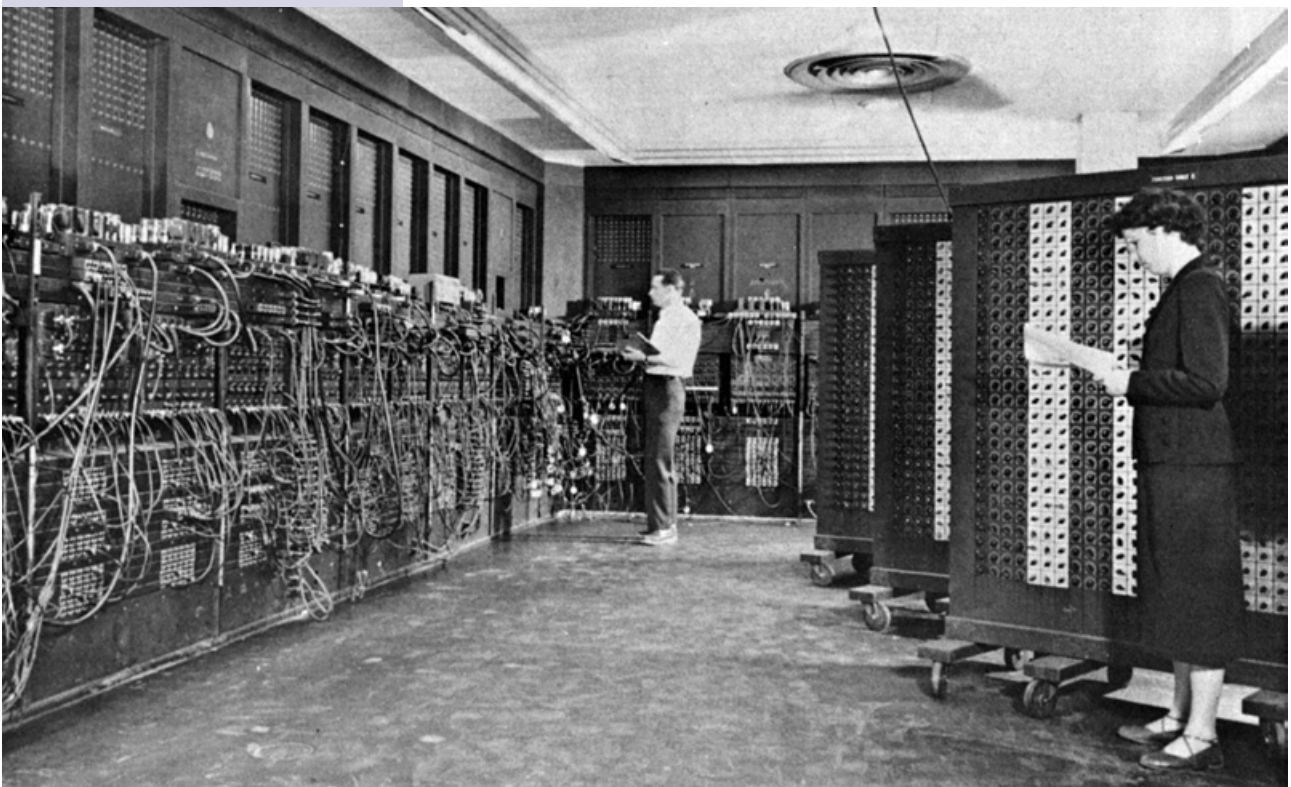
From AI to human-machine interfaces

Starting in the late 1990s, AI was coupled with robotics and human-machine interfaces to produce intelligent agents that suggested the presence of feelings and emotions. This gave rise, among other things, to the calculation of emotions (affective computing), which evaluates the reactions of a subject feeling emotions and reproduces them on a machine, and especially to the development of conversational agents (chatbots).

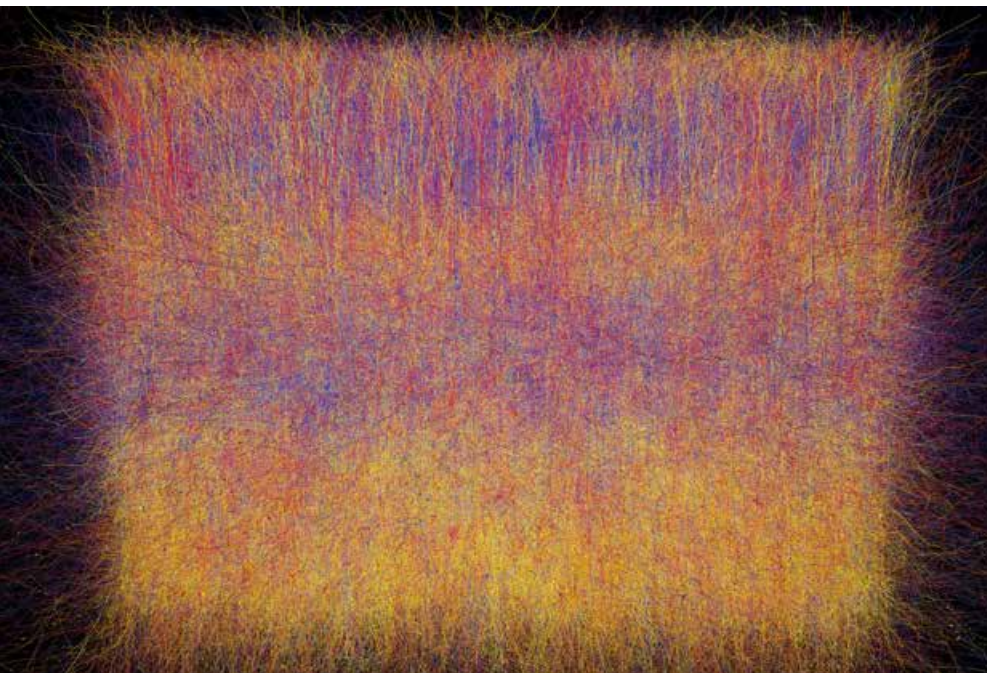
Renaissance of AI

Since 2010, the power of machines has made it possible to exploit enormous quantities of data (big data) with deep learning techniques, based on the use of formal neural networks. A range of very successful applications in several areas – including speech and image recognition, natural language comprehension and autonomous cars – are leading to an AI renaissance.

ENIAC (Electronic Numerical Integrator and Computer), the first programmable electronic digital computer, built in 1946, during the Second World War. Measuring 30 cubic metres and weighing 30 tons, it was developed by the University of Pennsylvania in the United States, and used to solve problems in nuclear physics and meteorology.



Public domain/ United States Army photo



© BBP/EPFL 2015

Simulation of electrical activity in a microcircuit of virtual neurons of a rat (2015), by the Blue Brain Project (BBP) team, part of Europe's Human Brain Project (HBP). According to scientists, it is a step towards simulating the functioning of the human brain.

Applications

Many achievements using AI techniques surpass human capabilities – in 1997, a computer programme defeated the reigning world chess champion, and more recently, in 2016, other computer programmes have beaten the world's best Go [an ancient Chinese board game] players and some top poker players. Computers are proving, or helping to prove, mathematical theorems; knowledge is being automatically constructed from huge masses of data, in terabytes (10¹² bytes), or even petabytes (10¹⁵ bytes), using machine learning techniques.

As a result, machines can recognize speech and transcribe it – just like typists did in the past. Computers can accurately identify faces or fingerprints from among tens of millions, or understand texts written in natural languages. Using machine learning techniques, cars drive themselves; machines are better than dermatologists at diagnosing melanomas using photographs of skin moles taken with mobile phone cameras; robots are fighting wars instead of humans (see p. 25-28); and factory production lines are becoming increasingly automated.

Scientists are also using AI techniques to determine the function of certain biological macromolecules, especially proteins and genomes, from the sequences of their constituents – amino acids for proteins, bases for genomes. More generally, all the sciences are undergoing a major epistemological rupture with *in silico* experiments – named so because they are carried out by computers from massive quantities of data, using powerful processors whose cores are made of silicon. In this way, they differ from *in vivo* experiments, performed on living matter, and above all, from *in vitro* experiments, carried out in glass test-tubes.

Today, AI applications affect almost all fields of activity – particularly in the industry, banking, insurance, health and defence sectors. Several routine tasks are now automated, transforming many trades and eventually eliminating some.

What are the ethical risks?

With AI, most dimensions of intelligence – except perhaps humour – are subject to rational analysis and reconstruction, using computers. Moreover, machines are exceeding our cognitive faculties in most fields, raising fears of ethical risks. These risks fall into three categories – the scarcity of work, because it can be carried out by machines instead of humans; the consequences for the autonomy of the individual, particularly in terms of freedom and security; and the overtaking of humanity, which would be replaced by more “intelligent” machines.

However, if we examine the reality, we see that work (done by humans) is not disappearing – quite the contrary – but it is changing and calling for new skills. Similarly, an individual's autonomy and freedom are not inevitably undermined by the development of AI – so long as we remain vigilant in the face of technological intrusions into our private lives.

Finally, contrary to what some people claim, machines pose no existential threat to humanity. Their autonomy is purely technological, in that it corresponds only to material chains of causality that go from the taking of information to decision-making. On the other hand, machines have no moral autonomy, because even if they do confuse and mislead us in the process of making decisions, they do not have a will of their own and remain subjugated to the objectives that we have assigned to them.

French computer scientist

Jean-Gabriel Ganascia is a professor at Sorbonne University, Paris. He is also a researcher at LIP6, the computer science laboratory at the Sorbonne, a fellow of the European Association for Artificial Intelligence, a member of the Institut Universitaire de France and chairman of the ethics committee of the National Centre for Scientific Research (CNRS), Paris. His current research interests include machine learning, symbolic data fusion, computational ethics, computer ethics and digital humanities.



A bionic hand that sees



Chen Xiaorong

An intuitive bionic hand that can “see” objects by itself and is capable of precise and smooth handling, could change the lives of people with upper-limb disabilities. Designed by biomedical engineers at Newcastle University, this prosthesis illustrates the collaboration between human intention and the technical efficiency of artificial intelligence (AI).

This bionic hand is capable of quickly and easily grasping any object, using a camera to assess its shape and dimension, which then triggers the correct movement to pick it up.

© Newcastle University, UK

When Doug McIntosh, an amputee taking part in a clinical trial, was able to quickly and efficiently grab an object for the first time in twenty years without the slightest effort, the designer of the bionic hand he was wearing said that no reward was greater than seeing the joy on his face.

“It showed my innovation was successful and my tester was happy with it,” said Dr Kianoush Nazarpour, a biomedical engineer at the Institute of Neuroscience at Newcastle University, in the United Kingdom. The bionic hand is one of the winners of the Netexplo Innovation Awards 2018.

The new generation of prosthetic limbs allows the wearer to grip objects without the use of the brain, automatically and without thinking. It is just like a real hand, whose ability to grasp objects correctly we take so much for granted.

The usual process requires the user to see the object, physically stimulate the muscles in the arm and trigger a movement in the prosthetic limb. In the new version, a tiny camera (which costs less than \$1.50) fitted on the bionic hand takes a picture of an object in front of it, assesses its shape and size, and triggers a series of smooth movements to pick up the object – in a matter of seconds.

The device demands nothing more of the wearer than a quick glance in the right direction. Choosing from four different “grasps” – suitable for picking up a cup, holding a TV remote controller, gripping objects with a thumb and two fingers, or a pinched thumb and first finger – the hand uses artificial intelligence to continually improve its detection and grasping skills. It is ten times faster than current bionic limbs.

“Responsiveness has been one of the main barriers to artificial limbs – controlling them takes practice, concentration and time,” explains Nazarpour. “Prosthetic limbs have changed very little in the past 100 years – the design is much better and the materials are lighter in weight and more durable, but they still work in the same way,” he adds. “The beauty of this system is that it’s much more flexible and the hand is able to pick up novel objects – which is crucial, since in everyday life people effortlessly pick up a variety of objects that they have never seen before.”

Nazarpour, who has focused his research on improving prosthetics since 1999, grew up in Iran, dreaming of becoming a medical doctor. His research is motivated by the potential of prosthetics to restore function to individuals with sensorimotor deficits, by transforming thought into action and sensation into perception.

The crucial point is to understand how the peripheral nervous system responds to electro-mechanical stimulation of the limb, which helps to inform the design of prostheses. An electro-mechanical design and computer programme are available online, which can be adapted to or installed in various artificial upper-limb products.

“We produce a device and software control system, but not the artificial hands,” Nazarpour said, adding that the hardware costs just \$1. Beyond the obvious benefit for disabled people, the bionic hand could belong to an intelligent robot, and be of interest to industry and businesses.

Recent statistics show that in the UK there are around 600 new upper-limb amputees every year, fifty per cent of whom are 15 to 54 years old. The number is much higher in the United States, with 500,000 new upper-limb amputees every year. “We plan to cooperate with many prosthetics producers and we need to build up networks,” Nazarpour, whose team is still perfecting the design, said. “I hope this can help thousands of people in the world.”



Of robots *and humans*



© Pascal Meunier / Cosmos

Vanessa Evers

For an artificial agent to assume a real social role and establish a meaningful relationship with a human, it would need to have a psychological, cultural, social and emotional profile. Current machine learning methods do not allow for such a development. Tomorrow's robots will be our humble assistants, nothing more.

We live in a time when robots clean our houses, drive our vehicles, disable bombs, provide prosthetic limbs, support surgical procedures, manufacture products, entertain, teach and surprise us. Just as smartphones and social media are offering a connectivity beyond anything we imagined, robots are beginning to offer physical capabilities and artificial intelligence (AI), cognitive abilities beyond our expectations. Together, these technologies could be harnessed to help solve important challenges, such as ageing societies, environmental threats and global conflict.

What will a day in our lives look like, in this not-so-distant future? Science fiction has explored these possibilities for centuries. Our lives will likely be longer: with synthetic organs to replace defective parts of our bodies, nanosized medical interventions allowing the precise targeting of diseases and genetics, and autonomous vehicles reducing fatalities in traffic.

The residents of the Tsukui retirement home in Kawasaki, Japan, do some gymnastics with their coach, Pepper (2015).

Our jobs will change dramatically. Certain jobs will not exist anymore and new jobs will emerge – in the development of robot service apps, for instance, that could run on available robot platforms in our homes. The way we are educated will also change radically (see p. 34-35) – our senses and brains may be artificially enhanced, and our ability to reflect on new insights gained from the automated analysis of vast amounts of data will require a different treatment of information in schools.

But how will we relate to each other in a civilization that includes robots? In what way will we meet each other, have relationships and raise our children? To what extent will robots and humans merge?



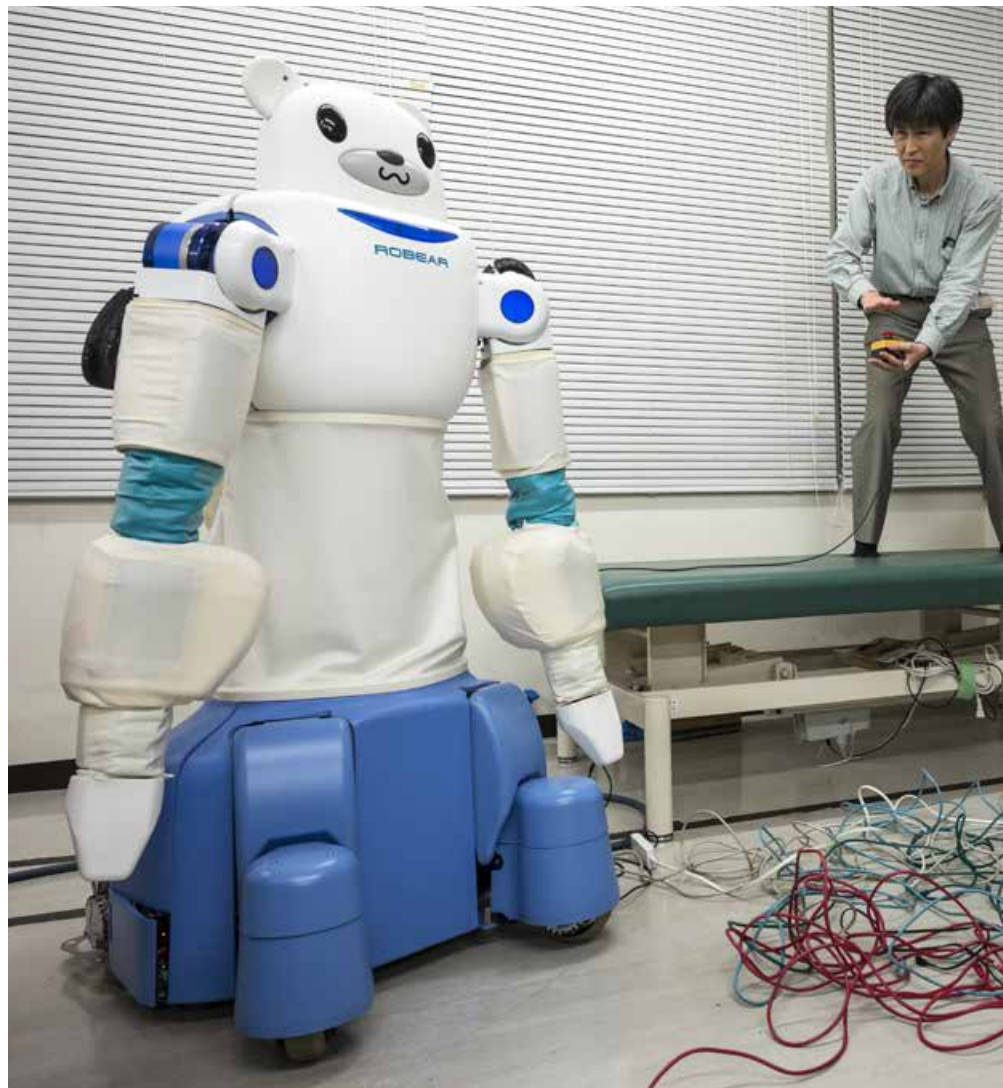
Many of us wonder whether AI will become so intelligent and capable in human communication that the boundaries between human and artificial beings will blur. If it is possible to communicate in a natural way and build a meaningful interaction over time with an artificial agent, will there still be a divide in the relationships we have with people and technology? Also, once our human bodies and minds are enhanced with AI and robotics, what will it mean to be “human”?

Smart tricks

From an engineering perspective, these advanced capabilities are still very far away. A number of hurdles need to be overcome. For now, robots and computers are completely dependent on a power source – they require a lot of electricity, and this complicates integrating robotic elements with human organic tissue. Another hurdle is the intricacy of human communication. While a one-off natural language conversation in a specific context with a robot can feel realistic, engaging people verbally and non-verbally over many conversations and contexts is quite another matter.

For example, when you call an artificial lost-and-found agent at an airport, a satisfying conversation is possible because there are only a limited number of goals the caller has. However, in creating a more extended relationship, for example, with a robotic pet, a much more complicated model must be developed. The robot needs to have internal goals, an extensive memory that relates experiences to various contexts, and it needs to develop these capabilities over time.

Through smart “tricks”, a robot can seem more intelligent and capable than it is – by introducing random behaviours which make the robotic pet interesting for longer, for instance. Humans have the tendency to “make sense” of the robot’s behaviours in a human way (we do this with animals too).



© Pascal Meunier / Cosmos

However, in order to sustain a meaningful relationship which deepens and evolves over time, an extensive artificial inner life will need to be created.

How machines learn

A major hurdle in creating this rich artificial inner life is the way machines learn. Machine learning is example-based. We feed the computer examples of the phenomenon we want it to understand – for instance, when people feel comfortable. In teaching a machine to recognize this, data of people being comfortable is provided – this could be in the form of images, videos, their speech, heartbeat, social media entries, etc. When we feed videos to a computer, these are labelled with information on whether the people in it are comfortable or not – this may be done by experts in psychology, or in the local culture.

The computer uses machine learning to “reason” from these labelled videos to identify important features that correlate with feeling comfortable. This could be the body pose of a person, the pitch of their voice, etc.

Once the machine has identified the features predicting “comfort”, the resulting algorithm can be trained and improved, using different sets of videos. Eventually, the algorithm is robust and a computer with a camera can recognize how people feel with high, if not 100 per cent, accuracy.

Now that we understand roughly how machines learn, why is that a hurdle in creating a compelling inner life for an artificial agent to realize a seamless integration with humans?



Robots, a new generation of workers, are helping to remedy the shortage of carers in Japanese hospitals. Riba, invented by Toshiharu Mukai, can carry patients weighing up to eighty kilos.

Towards a complex synthetic profile

In order to develop an artificial agent that can have a sustained relationship, over a long period of time, with a person, we need the agent to have a compelling personality and behaviours, understand the person, the situation in which they are both in, and the history of their communication. More importantly, the agent would have to keep the communication going across a variety of topics and situations. It is possible to make a compelling agent, such as Amazon's Alexa or Apple's Siri, that you can speak to in natural language and have a meaningful interaction with, within the specific context of its use – set the alarm clock, make a note, turn down the heating, etc.

However, beyond that context of use, the communication quickly breaks down. The agent will find acceptable responses for a large variety of questions and comments, but will not be able to sustain an hour-long discussion about a complex issue. For instance, when parents discuss how to respond to their child not working hard at school, the conversation is very rich – they bring to it their understanding of the child, and their own personalities, emotions, history, socio-economic and cultural backgrounds, psychology, genetic make-up, behavioural habits and understanding of the world.

In order for an artificial agent to take on such a meaningful social role and develop a real relationship with a person, it would need to have a synthetic psychological, cultural, social and emotional profile. Also, the agent would need to learn over time how it “feels” and respond to situations in relation to this synthetic internal make-up.

This requires a fundamentally different approach to current machine learning. An artificially intelligent system that develops much like how the human brain develops, and that can internalize the richness of human experiences, is needed. The intricate ways people communicate with each other and understand the world is an unimaginably complex process to synthesize. The envisioned and currently available models of AI are inspired by the human brain or have elements of how the brain works, but are not yet plausible models of the human brain.

We already see AI achieving amazing feats – like reading the entire internet, winning at Go, the ancient Chinese board game, or running a fully automated factory. However, just like the English physicist Stephen Hawking (1942-2018) said he had only scratched the surface of understanding the universe, we are still merely scratching the surface of understanding human intelligence.

It won't happen tomorrow

Robots and artificially intelligent systems will be able to offer us unique abilities to support and enhance our decision-making, understanding of situations and ways to act. Robots will be able to contribute to or autonomously carry out labour. Perhaps robotics will be fully physically integrated in our human bodies once a number of challenges are overcome. Also, we will relate to artificial agents as we do to humans – by communicating with them in natural language, observing their behaviours and understanding their intentions. However, in order to sustain a meaningful relationship with conversations and rituals, which deepen and evolve over time in the rich context of everyday life, as is the case between people, an extensive artificial inner life will need to be created. As long as we replicate or surpass certain functions of human intelligence rather than the holistic whole of human intelligence placed in the rich context of our everyday lives, it is unlikely that artificial agents and people can be totally integrated.

Active in developing robotic solutions, **Vanessa Evers** (The Netherlands) is a professor of Computer Science at the Human Media Interaction group and Scientific Director of the DesignLab at the University of Twente. She has published almost 200 peer-reviewed publications, is an editor for the *International Journal of Social Robotics* and a senior editor of the *Journal of Human-Robot Interaction*.



Chef Giuseppe heralds a new culinary era

© Cristhian Guzmán / Paula Magazine



*Karim Pichara, Matías Muchnick
and Pablo Zamora,
founders of The Not Company.*

Beatriz Juez

Giuseppe could radically change our eating habits. But this futuristic master chef is only an algorithm! He was created by The Not Company (NotCo), a startup founded in Santiago by three young Chileans in 2015. With the aid of artificial intelligence (AI), they produce substitutes of popular animal-based foods, using only plant-based ingredients to reconstitute not just the taste, but also the colour, texture and nutrients. For his innovation, Giuseppe was named one of the ten laureates of Netexplo Innovation 2018.

He was named after Giuseppe Arcimboldo (1527-1593), the Italian Renaissance painter who was famous for his portraits of faces made up of flowers, fruits, plants and animals. "His paintings tell us that, with intelligence, talent, and lots of fruit and vegetables, we can solve everything," explains biochemist Pablo Zamora, co-founder of NotCo, along with Matías Muchnick and Karim Pichara.

Our Giuseppe's passion is not painting, but cooking. To find the right recipe, this intelligent chef searches a database of plants – to identify which foods need to be combined, and in what proportions – to produce the desired taste and texture of the food being substituted.

"He finds unusual links between plants that he has previously classified at a molecular, nutritional, sensorial and physiochemical level," explains Zamora, who attended the Netexplo Forum 2018, held in February at UNESCO Headquarters in Paris.

Luckily, Giuseppe is not the only one in the kitchen. He is supported by a team of scientists and chefs who fine-tune the recipes. "He sometimes makes mistakes," Zamora admits. "He can make milk that tastes perfect, except it's pink! So the team tells Giuseppe there's a problem and he reformulates the algorithm to get the right colour."

Giuseppe never ceases to surprise with his combinations of ingredients, which no human could think up. "For mayonnaise, we use lupines, which, mixed with certain chickpea components, makes an emulsion very close to that of eggs. Mushrooms are used to heighten the sensation of sweetness in chocolate and canary grass seeds to alter the density of certain milks."

NotCo is on a mission to revolutionize the food industry by crafting and marketing healthy and tasty foods obtained from plants, at an affordable price and produced without harming the environment. According to Zamora, eighty-five per cent of their clients are neither vegan nor vegetarian – they buy NotCo's cutting-edge products because they like them and because they are healthy and good for the environment. It is indeed the beginning of a new era of food: the idea is to "change the way we make the foods that we love eating, not change the foods we eat."

Vegetable mayonnaise

The company's Not Mayo vegetable seasoning that resembles mayonnaise – but without GMOs, lactose, gluten, eggs or soya – is already on the Chilean market. Other products – yogurt, milk, cheese, chocolate and cereals – will be launched soon. NotCo also plans to expand to Argentina, Brazil and Colombia in the near future.

The biochemist is convinced that the application of artificial intelligence to food will contribute to sustainable development. The food industry needs to transform its production methods, he says, reminding us that 1,500 litres of water are needed to produce a kilo of wheat and ten times that amount to produce a kilo of meat, according to the Food and Agriculture Organization (FAO).



Humans, not machines, create meaning

Miguel Benasayag,
interviewed by Régis Meyran

In the term “artificial intelligence” (AI), the word “intelligence” is just a metaphor. While an AI may surpass humans in terms of calculating capacity, it is unable to ascribe any meaning to these calculations. For the Argentinian philosopher and psychoanalyst Miguel Benasayag, reducing the complexity of a living being to computer code is a mistake – just as the idea that machines can substitute humans is absurd.

What distinguishes human intelligence from AI?

Living intelligence is not a calculating machine. It is a process that articulates affectivity, corporeality, error. In human beings, it presupposes the presence of desire and an awareness of their own history over the long term. Human intelligence is not conceivable separately from all other cerebral and corporeal processes.

Unlike humans or animals who think with the help of a brain located inside their bodies – which itself exists in an environment – a machine produces calculations and predictions without being able to give them any meaning. The question of whether a machine can substitute humans is, in fact, absurd. It is living beings that create meaning, not computation. Many AI researchers are convinced that the difference between living intelligence and artificial intelligence is quantitative, whereas it is qualitative.



© Jordi Isern (www.jordisern.net)

From the series *Constellations* (2014),
by Spanish artist Jordi Isern.

Two computers in the Google Brain programme could apparently communicate with each other in a “language” that they themselves created and which humans could not decipher. What do you think of this?

That just doesn’t make any sense. In reality, each time these two machines are launched, they systematically repeat the same sequence of information exchange. And this is not a language, it does not communicate. It is a bad metaphor, like the one that says the lock “recognizes” the key.

It’s rather like when some people say they are “friends” with a robot. There are even smartphone applications that supposedly let you “chat” with one. In Spike Jonze’s film, *Her* (2013), a man is asked a series of questions, which enables his brain to be mapped. A machine then synthesizes a voice and fabricates responses that trigger a feeling of being in love, in the man.

But can you really have a romantic relationship with a robot? No, because love and friendship cannot be reduced to a set of neuronal transmissions in the brain.

Love and friendship exist beyond the individual, and even beyond the interaction between two people. When I speak, I am participating in something that we share in common, language. It is the same for love, friendship and thought – these are symbolic processes in which humans participate. Nobody thinks only for themselves. A brain uses its energy to participate in thinking.

To those who believe that a machine can think, we must respond that it would be astonishing if a machine could think, because even the brain does not think!

In your opinion, is reducing a living being to code the principal failing of AI?

Indeed, some AI experts are so dazzled by their own technical achievements – rather like little boys fascinated by their construction games – that they lose sight of the big picture. They fall into the trap of reductionism.

In 1950, the American mathematician and father of cybernetics, Norbert Wiener, wrote in his book, *The Human Use of Human Beings*, that one day we might be able to “telegraph a man”. Four decades later, the transhumanist idea of “mind uploading” has been built on the same fantasy – that the whole real world can be reduced to units of information that can be transmitted from one piece of hardware to another.

The idea that living beings can be modelled into units of information is also found in the work of the French biologist Pierre-Henri Gouyon, with whom I have published a book of interviews, *Fabriquer le vivant?* [Manufacturing the living? 2012]. Gouyon sees deoxyribonucleic acid (DNA) as the platform for a code that can be transferred to other platforms. But when we think that living beings can be modelled into units of information, we forget that the sum of information units is not the living thing, and no one is interested in carrying out research on what cannot be modelled.

Taking into account that which cannot be modelled does not lead us to the idea of God, or obscurantism, whatever some may think. The principles of unpredictability and uncertainty can be found in all the exact sciences. That is why the aspiration of transhumanists for total knowledge is part of a perfectly irrational, technophile discourse. It owes its considerable success to its ability to quench the metaphysical thirst of our contemporaries. Transhumanists dream of a life freed from all uncertainty. Yet in daily life, as in research, we have to contend with uncertainties and randomness.

According to transhumanist theory, we will one day become immortal, thanks to AI.

In our current postmodern turmoil, where we no longer ponder on the relationships between things, where reductionism and individualism dominate, the transhumanist promise takes the place of Plato’s cave.



© Laurent Philippe / Divergence

For the Greek philosopher, real life was not to be found in the physical world, but in the world of ideas. For transhumanists, twenty-four centuries later, real life lies not in the body, but in algorithms. For them, the body is just a façade – a set of useful information must be extracted from it, and then we need to get rid of its natural defects. That is how they intend to achieve immortality.

At scientific conferences, I have had the opportunity to meet several members of Singularity University [more a think-tank than a university, based in Silicon Valley in the United States, with an unwritten transhumanist approach] who wore medallions around their necks requesting that, if they died, their heads should be cryopreserved.

I see this as the emergence of a new form of conservatism, even though I am the one who comes across as a bioconservative, because I am opposed to the transhumanist philosophy. But when my critics call me a reactionary, they are using the same types of arguments as politicians – who claim to be modernizing or reforming, while eroding the social rights of a country and labelling as conservative, all those who want to defend their rights!

The hybridization of humans and machines is already a reality. That is also a transhumanist ideal.

We have not even begun to understand living beings and hybridization, because biological technology today still omits almost all of life, which cannot be reduced only to those physiochemical processes that can be modelled. Having said this, the living have already been hybridized with the machine, and this will certainly be even more so, with products resulting from new technologies.



Robot (2013), a performance created for dancers and robots by Spanish-French choreographer, Blanca Li, who takes a questioning look at a world inhabited by humans and machines.

There are many machines with which we work, and to which we delegate a number of functions. But are they all necessary? That's the whole point. I have worked on cochlear implants and the culture of deaf people. There are millions of deaf people who claim their own culture – which is not respected enough – and who refuse to have a cochlear implant because they prefer to express themselves in sign language. Does this innovation, which could crush the culture of deaf people, constitute progress? The answer is not intrinsically obvious.

Above all, we need to ensure that hybridization takes place with respect for life. However, what we are witnessing today is not so much hybridization as the colonization of the living, by machines. Because they externalize their memories, many people no longer remember anything. They have memory problems that are not the result of degenerative pathologies.

Take the case of Global Positioning Systems (GPS), for example. There have been studies on taxi drivers in Paris and London, both labyrinthine cities. While London taxi drivers navigate by orienting themselves, Parisians systematically use their GPSes. After a three-year period, psychological tests showed that the subcortical nuclei responsible for mapping time and space had atrophied in the Parisian sample (atrophy that would certainly be reversible if the person abandoned this practice). They were affected by a form of dyslexia that prevented them from negotiating their way through time and space. That is colonization – the area of the brain is atrophied because its function had been delegated, without being replaced by anything.

What worries you the most?

I am worried about the inordinate success of the logic of innovation. The notion of progress has misfired. It has been replaced by the idea of innovation, which is something quite different – it contains neither a starting point nor an end point, and is neither good nor bad. It must, therefore, be questioned critically. Using a computer word processor is much more powerful than the Olivetti typewriter I used in the 1970s – for me this is progress. But conversely, every smartphone contains dozens of applications and few people ask themselves seriously how many of them they really need. Wisdom consists of keeping a distance from the fascination provoked by entertainment and the effectiveness of new technologies.

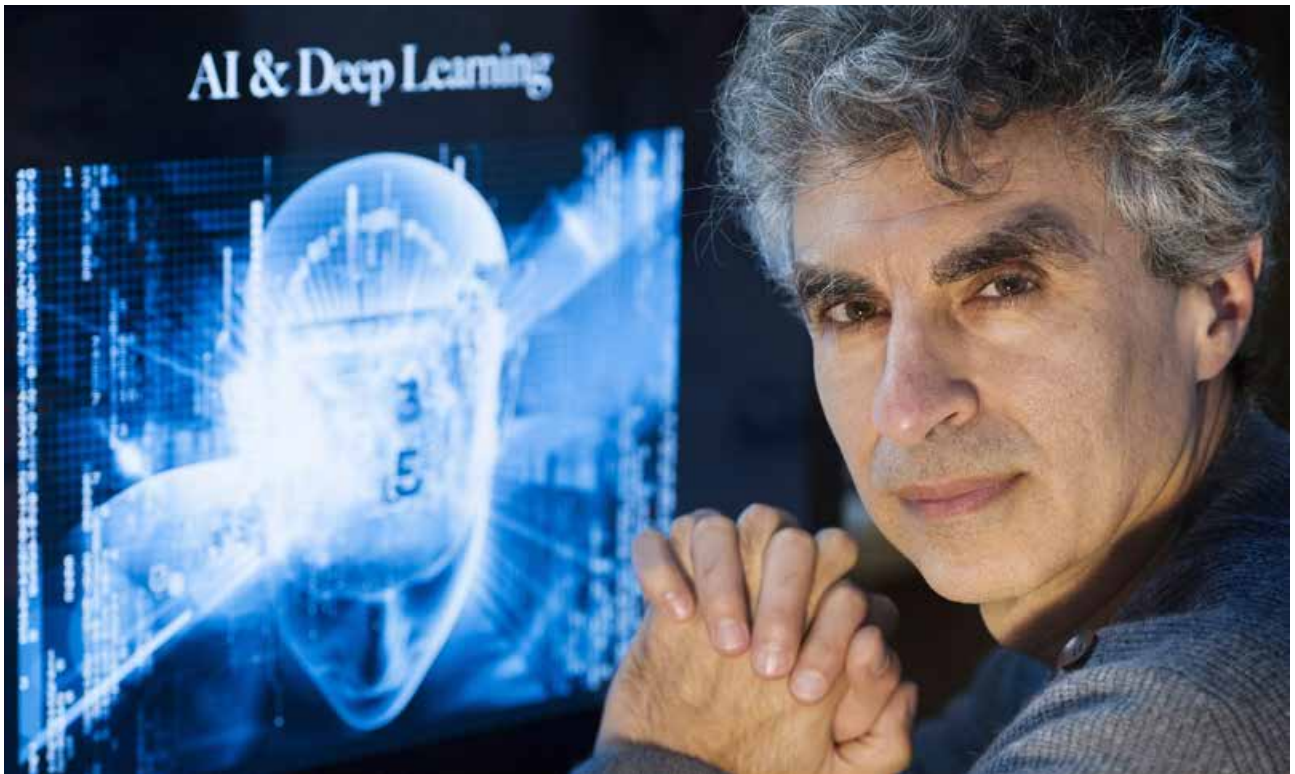
Also, in a disoriented society that has lost its great narratives, the transhumanist discourse is very disturbing – it infantilizes humans, and views the promises of technology without scepticism. In the West, technology has always referred to the idea of transcending limits. Already in the seventeenth century, the French philosopher René Descartes, for whom the body was a machine, had imagined the possibility of thought without a body. It is a human temptation to dream that, through science, we will free ourselves of our bodies and their limitations – something that transhumanists believe they will finally achieve.

But the dream of an all-powerful, post-organic man who knows no limits has all kinds of serious consequences for society. It seems to me that it should even be viewed as a mirror image of the rise of religious fundamentalism, which lurks behind the supposed natural values of humans. I see them as two irrational forms of fundamentalism at war.

A philosopher and psychoanalyst, **Miguel Benasayag** (Argentina) is a former member of Che Guevara's resistance against Juan Perón's regime. He succeeded in fleeing Argentina in 1978, after having been imprisoned and tortured there, and now lives in Paris. His recent publications include *Cerveau augmenté, homme diminué* (Augmented brain, diminished human, 2016) and *La singularité du vivant* (The singularity of the living, 2017).



Countering the monopolization of research



© The Canadian Press / Graham Hughes

Yoshua Bengio, interviewed by Jasmina Šopova

Artificial intelligence (AI) is still in its infancy. “Its level of reasoning is very superficial, not even equivalent to that of a frog,” says Yoshua Bengio, AI pioneer and an expert on deep learning. However, it already poses serious problems of monopolization and inequitable distribution, which can only be resolved on a global scale. International coordination is imperative in the development of AI, he cautions.

Over the last five years or so, basic AI research has been all the rage with some information technology giants, who are investing considerable sums of money in the field. Could you explain this phenomenon?

The answer is very simple. Science in AI has reached a level of maturity that makes it very useful for companies. The accumulation of big data and the increased computing power available, facilitate the development of new AI products, which will be even more profitable in the future than they are today.

Today, when we search the internet, we are constantly solicited by targeted advertising – these ads allow companies like Facebook, Amazon, YouTube, etc., to thrive. Currently, AI products have only a small share of the market. But economists predict that they will account for up to 15 per cent of the total production of goods within a decade. That is enormous.

Yoshua Bengio: “We must encourage greater diversity in the business world associated with AI, and avoid a monopoly situation.”

AI will then allow these companies to sell more, to get rich and to be able to pay the researchers they recruit even more than they do now. By increasing their customer base, they will increase the amount of data they have access to – and that data is a gold-mine that makes the system even more powerful.

All this creates a virtuous cycle, which is good for these companies but unhealthy for society. Such a concentration of power can have a negative impact on both democracy and the economy. It favours large companies and slows down the ability of small new companies to enter the market, even if they have better products to offer.



We must encourage greater diversity in the business world associated with AI and avoid a monopoly situation.

But the monopoly is already being established. How can this be remedied?

With anti-monopoly laws. History teaches us that they can be effective against the excessive power of some companies. Remember Standard Oil in the United States, which bought its competitors to monopolize the oil market? Or Hollywood, which until the middle of the twentieth century, controlled seventy per cent of film theatres and imposed its rule on the distribution of films? The legal decisions against these companies and some others, helped to rebalance the markets.

I believe that judicious advertising regulations can go a long way towards preventing the establishment of monopolies in AI research. We are all, in a way, prisoners of advertising and we often forget that we have the option of making a collective decision to regulate it, so that it is not harmful to society.

Besides, the services provided by large private companies like Google and Facebook could very well be made public – in the same way that television, which provides a similar service, is.

You have decided not to work in the private sector, haven't you?

Yes, I want to remain neutral. My project is to develop a science that is accessible to everyone, and not only to a few shareholders. I want research to develop in a way that it targets the most useful applications for humanity – and not necessarily the most profitable for the economy.

That said, I have tried to create a common ecosystem that is mutually beneficial to research and industry at the University of Montreal, where I work. Several private laboratories have been set up in Quebec's capital, and they collaborate with us. Researchers from industry are employed as associate professors at the university and help train students. Companies make donations to universities and give them complete freedom to choose which areas of research they will invest in.

What is the proportion of researchers working in the academic field today?

If I base my answer on the people I meet at major international conferences, I would say that it is about half. Five years ago, virtually all AI researchers worked in the academic field.

Private companies recruit talent from around the world. Does this contribute to brain drain in less developed countries?

Inevitably. That's why we must think collectively about how the poorest countries can benefit from the most recent research results – but also about how to create research centres within their universities. In Africa, for example, more and more academic institutions are offering courses in AI and summer schools (see page 20) are being organized, which are proving very useful.

In addition, there are a large number of courses, tutorials and codes available online for free. I meet many young people who have been trained through the internet. We must also look for the best ways to help these students train themselves.

Some countries, including Canada, are investing heavily in AI research.

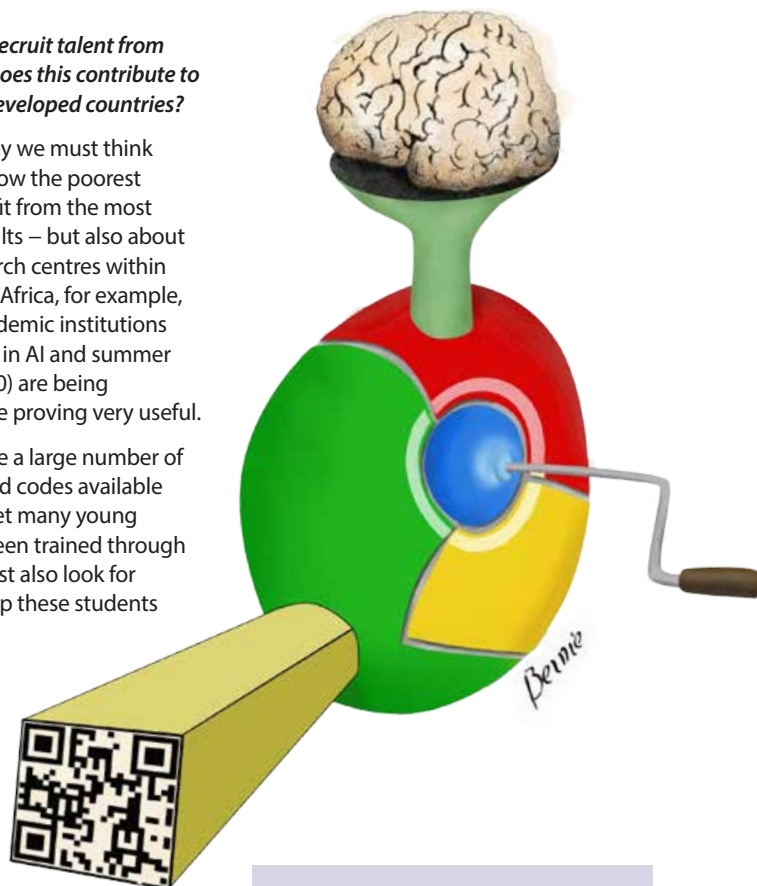
Yes, Canada has decided to fund not only basic research and to help startups, but also to invest in collective thinking and research in the social sciences and humanities, in order to assess the social impact of AI.

At the initiative of the University of Montreal, a debate was started on 3 November 2017 to help develop the Montreal Declaration for a Responsible Development of Artificial Intelligence. This approach essentially aims to establish ethical guidelines for the development of AI at the national level.

In the first phase of this long-term participatory process, the general public is invited to debate with experts and policymakers. Seven values have been identified: well-being, autonomy, justice, privacy, knowledge, democracy and responsibility.

At what stage is this reflection, at the international level?

To my knowledge, there is no international treaty governing AI research. Yet, these are international issues and without international coordination, we will not be able to move forward in the right direction.



Scanning your brain, by French cartoonist Bernard Bouton.

© Bernard Bouton / Cartoon Movement

First and foremost, the general public and policymakers must be made aware of the concerns about AI. In some parts of the world, researchers have already issued warnings about major problems, and the media and general public have responded. These are the first steps that will lead us towards a broader global political dialogue on the problems posed by this discipline, particularly in the areas of ethics, the environment and security.

Computer scientist and researcher **Yoshua Bengio** (Canada) is full professor of the Department of Computer Science and Operations Research (DIRO), University of Montreal; head of the Montreal Institute for Learning Algorithms (MILA); co-director of the Learning in Machines and Brains program of the Canadian Institute for Advanced Research (CIFAR) and Canada Research Chair in Statistical Learning Algorithms. The results of his research have been cited more than 80,000 times (as of September 2017). Born in Paris, Bengio moved to Quebec in 1977 at the age of 12, with his parents, who are of Moroccan origin. He is an Officer of the Order of Canada and a Fellow of the Royal Society of Canada.



Democratizing AI in Africa

Moustapha Cissé, interviewed by Katerina Markelova

He is 32 years old, and was born and raised in Senegal where he studied mathematics and physics. He earned master's degrees in artificial intelligence (AI) in France and Canada before returning to Paris to pursue a Ph.D. Two years ago, he joined Facebook AI Research (FAIR). Founded in 2013, it has since established laboratories around the world – in New York, Menlo Park (California), Paris, Montreal, and most recently, in Seattle and Pittsburgh. This, in short, is the story of Moustapha Cissé, who tells us about his research, his motivations and his hopes.

What projects are you working on in FAIR's Paris laboratory?

The topics that interest me most are the fairness, transparency and reliability of AI. In 2017, a group of colleagues and I were the first to develop algorithms (Houdini) that evaluate the robustness of intelligent systems, whatever the media: sound, video or other.

The robustness of algorithms is essential for the security of AI products. Imagine what could happen if someone malicious wanted to change the algorithm that drives your autonomous car! Any computer system can be attacked from the outside – by hacking or malicious modification. So it is essential to ensure its ability to resist such attacks.

Other work I recently published with a colleague involves equipping intelligent algorithms with the ability to treat all human beings fairly – which means that their behaviours are no different whether you are a man or a woman, black or white, etc.

In other words, I try to ensure that algorithms are not only as reliable as possible, but as relevant as possible to the needs and values of the human society they are meant to serve.

Studies have shown that facial recognition systems work better with European faces than with African ones, for example. It is the same for AI systems that identify skin cancers: they give better results for white patients than for black patients. Similarly, some systems were found to work better with men than with women. There is, therefore, a whole axiological dimension that has been neglected during the development of these systems. I am working with other colleagues to integrate this dimension from the very beginning in the construction of the AI models we are working on. This is a very important aspect of AI development, if we want it to be able to offer the same benefits to everyone.

You have said that the AI research community should stop focusing exclusively on "white people's problems".

I term all those technological advances that are in the realm of reality in the West "white people's problems", and the realm of the imagination elsewhere, such as autonomous cars, for instance. In Africa, but also in many parts of Asia and South America, people have other problems to deal with on a daily basis, the solutions of which depend on technologies that are much less sophisticated, and yet are non-existent. I believe that as a scientific community, we could have a much greater impact if we looked at the problems of these people to find solutions.

In concrete terms, how can people's lives be improved through AI?

When you give people the opportunity to access the information they need to build social connections, get more quickly integrated into an environment, find work, etc., you improve their lives. If you use AI to diagnose their diseases earlier and offer therapies, you also improve their lives.

AI is already changing many industries and I would like it to be made available to all those who need it – not just part of the world's population – to meet the various challenges of this century. For my part, I try to make things move in that direction, at my level. And I remain convinced that the AI research community is making giant strides.

How can the most disadvantaged be given access to these technological advances?

If this technology is to be accessible to all, it must be taught everywhere. It is through education that it will be placed in the hands of those who need it most. And I guarantee you that if you give them the means, people will find solutions to their own problems.

For the last three years, I have started, along with a group of friends, to teach AI at summer schools organized in Africa, by Data Science Africa, a non-profit professional knowledge-sharing group. Every summer, for a week or two, we introduce various AI techniques to students and teachers who want to discover this scientific discipline.

Last year, we launched the Black in AI initiative with a group of other friends. It brought together more than 200 black researchers (not counting the Americans) at the 30th edition of the world's largest AI science conference, Neural Information Processing Systems (NIPS 2017).



© Maurice Mbikayi / Image courtesy of Gallery MOMO



In previous years, we were not even ten, out of a total of more than 5,000 participants.

So, at our modest level, we are trying to democratize AI and access to information about the discipline. I am aware that this is not enough and that greater action is needed, but I remain optimistic.

Are these initiatives that you have launched on your own, or are they part of your work at FAIR?

These are initiatives that I launched personally with friends, but I have received logistical and financial support from Facebook, which sponsored most of the participation of about fifty young African researchers at the conference I just talked about.

Narcisurfing Netizenship (2015), sculpture by Maurice Mbikayi from the Democratic Republic of the Congo, who is particularly interested in the impact of modern technology on society, especially in Africa.



The Fourth Revolution

Yang Qiang, interviewed by Wang Chao

After the internet and mobile internet triggered the Third Industrial Revolution, artificial intelligence (AI) technologies, driven by big data, are fuelling a Fourth Industrial Revolution.

How did the convergence between AI and big data occur?

The rise of AI and big data started in the early 2000s. When Google and Baidu – the emerging search engines at the time – used AI-powered recommendation systems for advertising, they found that the results were much better than expected. The more data they collected, the better the results would be. But at the time, no one realized that this would be the case in other fields as well.

A real turning point occurred with the emerging of ImageNet, the largest image recognition database in the world, designed for use in visual object recognition software research. Established by computer scientists at Stanford and Princeton universities in the United States, it is considered to be the beginning of the deep learning revolution. The large amount of image data on ImageNet resulted in a ten per cent drop in the rate of mis-recognition. This showed that the convergence of deep learning and big data could help master extremely complex calculations.

How would you define the relationship between deep learning and big data?

If an AI system is designed well, the product will be more convenient to use, more accurate, and therefore, more useful. There will be more users, and hence more data – which in turn, makes the AI system better. A mutually strengthening relationship exists between AI systems and data.

Big data and AI could be merged into a new kind of AI, called data intelligence.

Could you define big data thinking? How could companies adapt to this way of thinking and what changes would they need to make?

The first point of big data thinking is to consciously collect data. In other words, before doing any business, you have to think about how to collect data.

Second, data collection and core algorithms are closely related. You need to know what is missing according to the algorithms, and then collect data with a specific purpose, including data from different sources.

The third requirement is to form a closed loop. The services provided by a software system should be able to stimulate the source to generate more data that can be fed back into the system, forming a closed loop. This allows for a continuous process of self-improvement and self-refinement of the system. A special design is required for the closed loop, which is very different from the previous design used for business.

Could you elaborate further on a closed loop design for AI and big data?

The first thing to consider are data providers – for example, users. All user behaviours need to be recorded in the form of data. Then service providers – such as WeChat Pay, the Chinese mobile wallet and Taobao, the Chinese e-commerce website – have to be taken into account. Intelligent feedback is generated based on the data to understand the needs of users. Users provide feedback data to the service providers, and service providers in turn provide the service data to the users. This forms a closed loop.

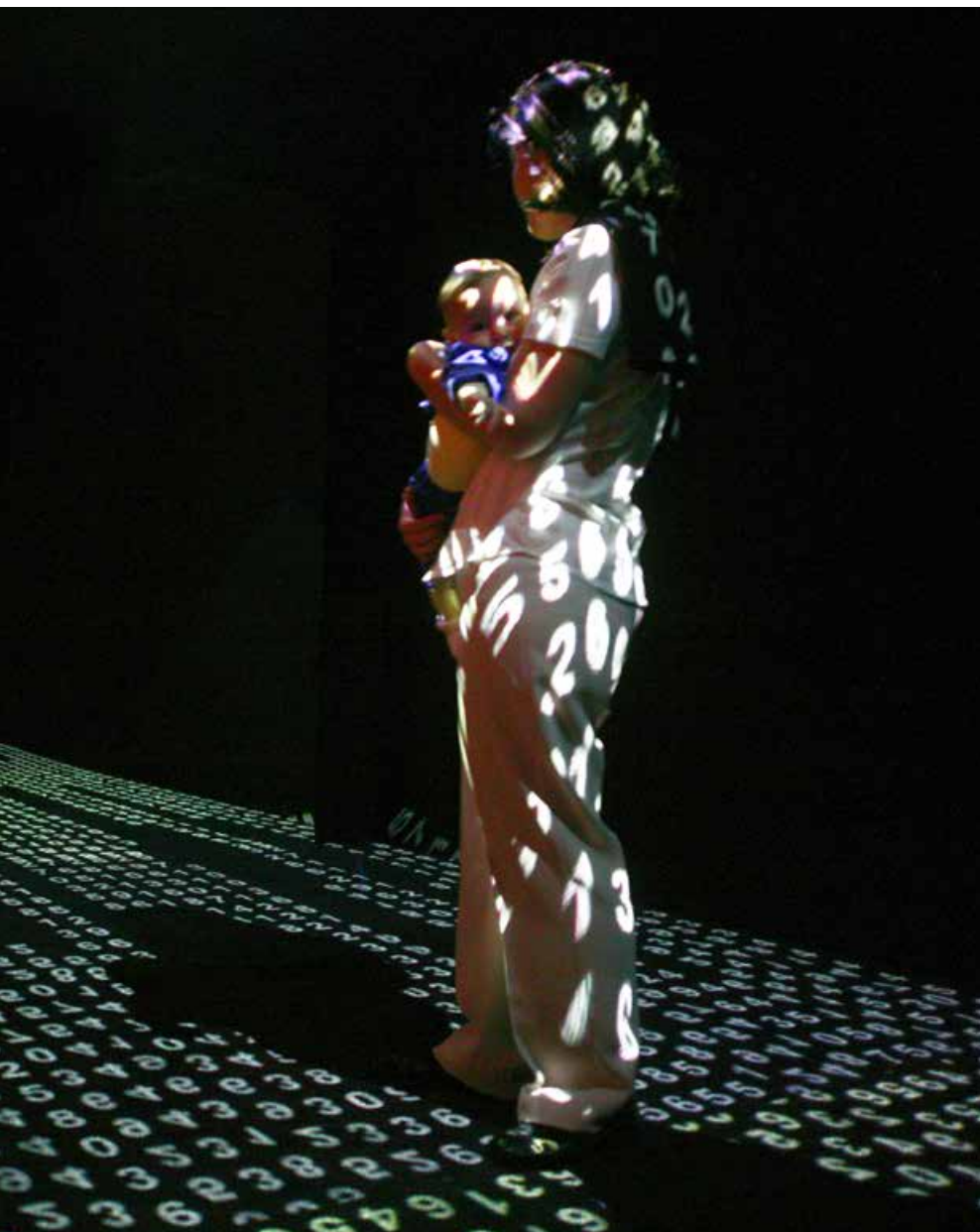


© Raquel Kogan / photo Domingues Freitas

Reflection#2, installation by Brazilian artist Raquel Kogan. Computer-generated numbers are projected in a darkened room, so that the bodies of spectators are directly integrated into the work.



“The second phase of AI will truly reshape human society, giving it its future form”



For the closed loop to evolve rapidly, it should be short enough. And it is better not to have people involved in it, because the loop cannot be fully automated with human participation. Second, the update process in the loop should happen frequently – it is best if this happens several times a day, because it keeps updating the system. Third, the process must be continuous, so users are prompted to provide constant feedback. To sum up the process in three words, it should be short, frequent, fast.

In your opinion, how long will it take for this closed loop to actually be achieved?

I think the future development of AI will be divided into two stages. The first stage is that all industries will attempt to use the technology. For example, security and protection services will use facial recognition technology; the banking sector will use AI in risk control, and so on. These are single technologies and solutions serving existing industries.

The second phase will be the emergence of entirely new industries, with artificial intelligence at the core. For example, a bank that uses AI as the core technology can be completely driven by AI in terms of investment, service and credit. Bank clerks would only be required to make small adjustments. Building entirely new kinds of customer service systems would also be possible.

I think the second phase of AI will truly reshape human society, giving it its future form. Just as at the time when the internet was emerging, in the first stage, a traditional bookstore made a web page and considered itself an online bookstore, which was not the case. In the second phase, websites like Amazon were established, that were completely different from the traditional bookstore.

The combination of big data and AI could also threaten the information flow and social equity. How could the normal flow of large-scale data be ensured, without the infringement of personal privacy?

Products that are created by using big data and AI technologies will provide excellent new business models. However, the precondition for these business models to be implemented on a large scale would be to ensure the privacy of their users. Here are three concerns:

First, we need a set of legal and social rules to protect the ownership of data and to make it clear where the data can or cannot be used. In my opinion, the user data should be divided into different divisions. For example, data in the red zone cannot be touched, data in the yellow zone is accessible only to some people, whereas everyone has access to data in the green zone. There is currently no consensus on the division of data. Besides, there is no law that specifies the definition of the person in charge and the penalties for violating these legal rules.



The second concern is to protect data privacy technically. For example, 4Paradigm (a Beijing-based AI technology and service provider) is currently studying the use of “migration learning” to protect privacy, which is a relatively new field. This could help different companies exchange data. For example, A makes a model, and the model is moved to scene B. Instead of exchanging data directly between A and B, it is included in the model. This is better for the protection of user privacy.

Third, we need to conduct more research on user privacy and data pricing. For example, when users click on an online advertisement through an AI recommendation system, should this system get some of the profits? If a search engine earns revenue, should some of it be distributed to users? These issues are worth exploring.

In the next few years, everyone will realize the importance of the “landing” of AI. We’ll need to pay more attention to how to “land” AI, and to find out which areas are suitable for its application. Today, finance, the internet, and automated vehicles are suitable areas for the “landing” of AI.

From a global perspective, what impact will the combination of big data and AI have on developing countries?

I think big data and AI technologies would enable some emerging countries to catch up, or even surpass, traditional developed countries. Because in the future, economic competition will not be only about financial and economic scale, but more importantly, about the size of data and the speed of embracing the data economy. For example, the rapid development of China’s internet and mobile internet has allowed for the collection of a large amount of data. This will also accelerate the development of China’s AI industry, which may change the world balance.

On the other hand, if a country already has a good infrastructure and high-quality education, it could benefit from AI to achieve more efficient production. Just as the use of steam engines allowed some countries to develop more rapidly during the Industrial Revolution.

Yang Qiang (China) is an international expert in AI and data mining. He is the first Chinese chairman of the International Joint Conferences on Artificial Intelligence (IJCAI), a fellow of the Association for the Advancement of Artificial Intelligence (AAAI), the head of Department of Computer Science and Engineering at the Hong Kong University of Science and Technology, and the co-founder and chief scientist of 4Paradigm.

Wang Chao (China) is a journalist and team leader at the AI Studio of NetEase News, which covers the AI industry.

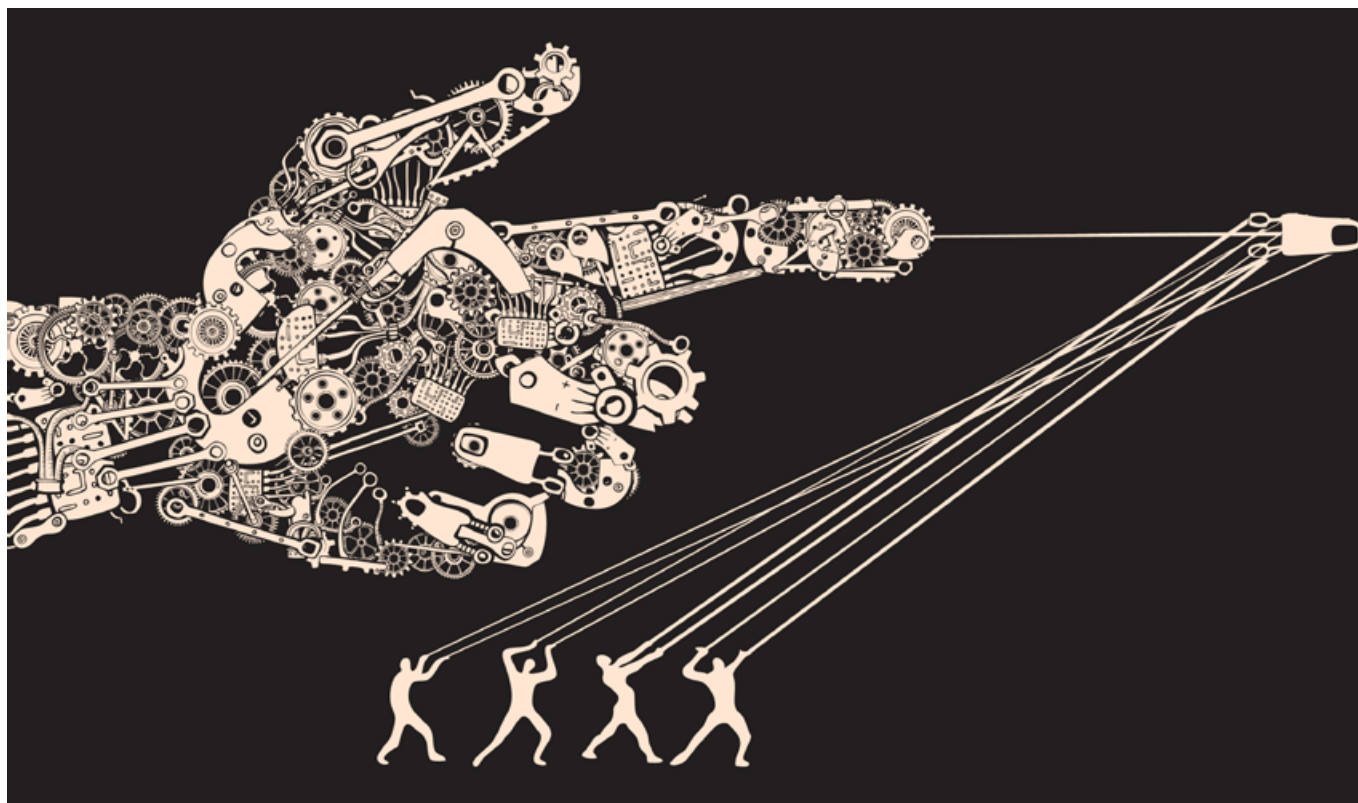
Songs of Anagura, an interactive exhibition introducing a field of research studying the collection, processing and use of data on position and human behaviour.



© Courtesy of Miraikan, National Museum of Emerging Science and Innovation, Tokyo, Japan



The threat of killer robots



© RYGER / Shutterstock

Public opinion is increasingly mobilizing against the development of lethal autonomous weapons.

Vasily Sychev

Artificial intelligence (AI) has a growing number of applications in the security and military areas. It facilitates manoeuvres in the field, and can save lives when things go wrong. It also boosts the performance of armies by providing robot allies to combat forces. According to some experts, Lethal Autonomous Weapons Systems (LAWS) are creating a “Third Revolution” in warfare, after gunpowder and nuclear weapons. It is time we start worrying about the day when armies of robots are capable of conducting hostilities with full autonomy, without humans to command them.

Many corporations around the world are conducting vital scientific research in the field of AI. The results to date have been excellent – AI has learned to predict a person’s risk of developing diabetes with the use of a smartwatch, or to tell the difference, based on their appearance, between moles and certain types of cancerous growths. This powerful tool, which surpasses human intelligence by one of its most important characteristics, speed, is also of interest to the military.

Thanks to the development of computer technologies, the weapons systems of the future will become more autonomous than those currently being used. On one hand, this empowerment will undoubtedly provide valuable assistance to combatants. On the other, it will bring its share of challenges and risks – it could set off arms races between countries, an absence of rules and laws in combat zones, and irresponsibility in decision-making. Today, many entrepreneurs, policymakers and scientists are seeking to prohibit the use of autonomous weapons systems, although military authorities insist that in combat, the final decision – to kill or not to kill – will always be made by a human.

We want to believe that. But we must remember, nuclear weapons – which should never have seen the light of day, and which have faced opposition from the earliest phase of their conception – has nevertheless been well and truly used.



A linear perspective drawing originally intended for publication in Crisis in Zefra, a fictional narrative by Karl Schroeder, who is interviewed in this issue of the Courier.

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A virtual assistant

As in all other spheres of human activity, AI can greatly facilitate and accelerate work in the field of security. For example, researchers at the University of Granada, Spain, are developing software that uses neural networks to detect small weapons – pistols, machine guns and submachine guns – on video images, almost instantly, and with great precision. Modern security systems include a large number of surveillance cameras whose operators simply cannot view every image. The AI is therefore very useful for analysing these images, detecting the presence of weapons and informing agents in record time.

In another example, the Center for Geospatial Intelligence (CGI) at the University of Missouri in the United States has developed an AI system capable of rapidly and accurately locating anti-aircraft missile devices on satellite and aerial images. The system's research capacity is up to eighty-five times faster than that of human experts. To form the neural network underlying this system, photographs representing different types of anti-aircraft missiles were used. Once the system was trained, it was tested on a set of photos. In just forty-two minutes, it found ninety per cent of the defensive devices. It took human experts sixty hours of work to solve the same problem, yielding the same result.

There are also more complex applications of AI. The US Army Research Laboratory (ARL), for example, is developing a computer system that analyses the human response to a given image. It will be useful for military analysts who need to view and systemize thousands of photos and hours of video recordings.

The principle of the system: the AI tracks the person's eyes and face and compares facial expressions with the images the person is looking at. If an image catches the person's attention (meaning the facial expression or the direction of his gaze changes), the software automatically moves it into a thematic folder. During the tests, a soldier was shown a set of images divided into five main categories: boats, pandas, red fruit, butterflies and chandeliers. He was asked to count only the images of the category he was interested in. The images scrolled at the rate of one per second. The AI "concluded" that the soldier was interested in the boats category and copied these images into a separate file.

In the field of combat

AI can also help soldiers in combat. In Russia, for example, the development of the fifth-generation Sukhoi Su-57 jet fighter is nearing completion; the plane could be commissioned before the end of 2018. The software of this stealth plane's flight computer contains elements of AI. Thus, in flight, the fighter plane is constantly analysing the quality of the air, its temperature, its pressure and many other parameters. If the pilot attempts to perform a manoeuvre and the system "estimates" the action will cause a crash, the pilot's command will be ignored. If the plane goes into a spin, the same system tells the pilot how to steady the plane and regain control.

Meanwhile, Japan is developing its own fifth-generation fighter. Its research prototype, the X-2 Shinshin ("Spirit of the Heart" in Japanese), made its first flight in April 2016. A vast network of sensors, which will analyse the condition of each component of the aircraft and determine any damage it has suffered, will ensure its "survival". If, during combat, an aircraft's wing or tail is damaged, its control system will be reconfigured so that its manoeuvrability and speed remain virtually unchanged. The Japanese fighter's computer will be able to predict the exact time at which a damaged element will fail entirely, so that the pilot can decide to continue the fight or return to base.

This makes AI a "godsend" – if such a term can be used for weapons and combat systems.



A complex programme capable of optimally solving a particular problem – ten times faster than a human can – not only facilitates the work of a reconnaissance aircraft, a drone operator or an air defence system commander, but it can also save lives. It would be able to come to the rescue of crew members aboard a submarine in distress (remotely putting out fires in compartments abandoned by humans), airplane pilots, or operators of damaged armoured vehicles.

Killer robots

Its speed of analysis and its ability to learn make AI attractive for combat systems. The military, although they still don't admit it, are probably already tempted to create combat systems capable of operating on the battlefield in a fully autonomous manner, which means being able to identify a target, open fire on it, move around and choose the optimal trajectories, allowing them to get to safety.

A few years ago, the military authorities of China, Germany, Russia, the US, and several other countries, announced that the creation of fully autonomous combat systems was not their objective. At the same time, the military forces noted that such systems are likely to be created.

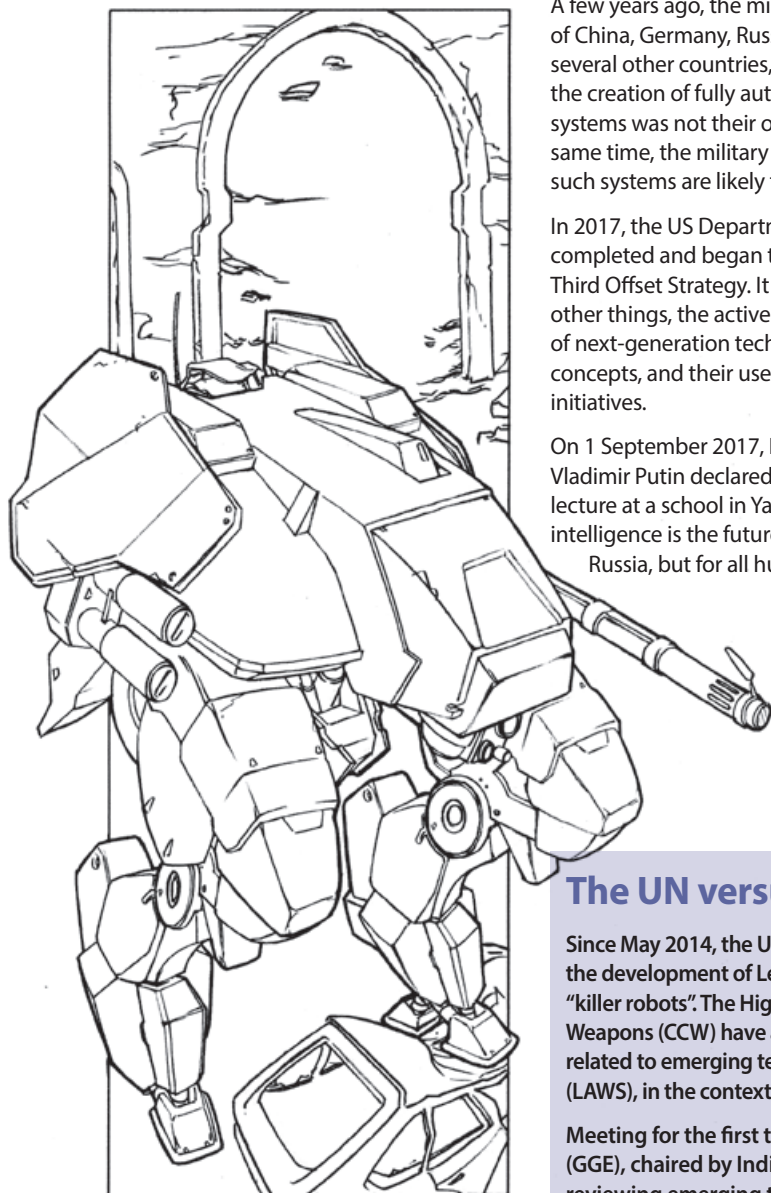
In 2017, the US Department of Defense completed and began to implement the Third Offset Strategy. It involves, among other things, the active development of next-generation technologies and concepts, and their use in future military initiatives.

On 1 September 2017, Russian President Vladimir Putin declared, at a public lecture at a school in Yaroslavl: "Artificial intelligence is the future, not only for Russia, but for all humankind."

It comes with colossal opportunities, but also threats that are difficult to predict today. Whoever becomes the leader in this sphere, will become the ruler of the world." He added that it would be "highly undesirable for anyone to gain a monopoly. So, if we become leaders in this field, we will share these technologies with the entire world." But does this mean that we are not at the beginning of a new era of arms races?

On Earth, a growing number of areas are reliably protected by anti-aircraft and anti-missile systems, monitored by satellite and unmanned systems, and patrolled by ships and aircraft. In the minds of the military, only combat systems with AI will be able to, in the event of war, penetrate these closed areas and operate with relative freedom.

Today, there are already combat systems capable of detecting and classifying their targets, and of controlling the firing of anti-aircraft missiles, such as the S-400 advanced surface-to-air defense missile systems in Russia. America's Aegis Combat System, which controls the arming of warships, works in the same way. Along the demilitarized zone, on the border with the Democratic People's Republic of Korea, the Republic of Korea has posted several SGR-A1 military robots in charge of surveillance. In automatic mode, they are able to open fire on the enemy, although they will not fire on people who have their hands up. However, none of these systems is used by the military in automatic mode.



A linear perspective drawing originally intended for Crisis in Zefra by Karl Schroeder, illustrating emerging technologies that could become part of Canada's Army of the Future.

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The UN versus LAWS

Since May 2014, the United Nations has been engaged in an international debate on the development of Lethal Autonomous Weapons Systems (LAWS), also known as "killer robots". The High Contracting Parties to the Convention on Certain Conventional Weapons (CCW) have adopted a new mandate: "to discuss further the questions related to emerging technologies in the area of lethal autonomous weapons systems (LAWS), in the context of the objectives and purposes of the Convention."

Meeting for the first time in November 2017, a Group of Governmental Experts (GGE), chaired by Indian Ambassador Amandeep Singh Gill, was tasked with reviewing emerging technologies in LAWS. One of the guidelines in the consensus report of this meeting is that the responsibility for the development of any conflict weapons system rests with the states. "States must be accountable for lethal acts by their forces in armed conflict," said Ambassador Singh Gill at the last GGE meeting in Geneva, Switzerland, on 9 April 2018.

Izumi Nakamitsu, UN Under-Secretary-General and High Representative for Disarmament Affairs, noted at the event that the new technologies were "giving rise very quickly to new methods and means of warfare with potentially undesirable or unclear consequences". She stressed on the responsibility of the group to "build consensus on common understandings on possible limits on the degree of autonomy in the use of lethal force".



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Armies of robots capable of waging war autonomously remain in the realm of science fiction. Still, many AI experts are extremely concerned about the possibility.

The latest advances in AI development make it possible to create combat systems that can move around. Thus, in the US, unmanned aircraft are being developed to fly behind human-operated fighter planes and target aerial or ground targets on command.

The fire control system of the next-generation Russian T-14 tank, based on the Armata universal heavy-crawler platform, will be capable of autonomously detecting targets and bombarding them until they are completely destroyed. Russia is also simultaneously working on a family of tracked robots that will be able to participate in combat with human soldiers.

For armies, all these systems are called upon to perform several basic functions – most importantly, to destroy enemy targets more efficiently and to save the lives of their own soldiers. At the same time, there are still no international standards or legal documents to regulate the use of combat systems equipped with AI in war. Neither the Laws and Customs of War on Land nor the Geneva Conventions define which AI systems can be used in combat and which cannot.

Nor is there any international legislation that would help identify those responsible for the failure of an autonomous system. If a drone bombards civilians autonomously, who will be punished? Its manufacturer? The commander of the squadron to which it was assigned? The Ministry of Defence? The chain of potential culprits is too long and, as we know, when there are too many culprits, nobody is guilty.

In 2015, the US-based Future of Life Institute published an open letter signed by more than 16,000 people, warning of the threats that AI-based combat systems pose to civilians, the risk of an arms race, and ultimately, the danger of a fatal outcome for humanity. It was signed, notably, by the American entrepreneur and founder of SpaceX and Tesla, Elon Musk, the British astrophysicist Stephen Hawking (1942-2018), and the American philosopher Noam Chomsky. In August 2017, Musk led a group of 116 AI experts to send a petition to the United Nations, calling for a total ban on the development and testing of autonomous offensive weapons.

These experts believe that the creation of robot armies capable of conducting hostilities autonomously will inevitably lead to the emergence of feelings of absolute power and impunity among them. Moreover, when humans are in a conflict situation, they make decisions that include, inter alia, their moral attitudes, feelings and emotions. The direct observation of the suffering of others still has a deterrent effect on military personnel, even if compassion and sensitivity eventually diminish among professional soldiers. In the event of the widespread introduction of LAWS, the effects of which can be unleashed simply by swiping the screen of a tablet on another continent, war will inevitably become nothing more than a game, with civilian and military casualties reduced to numbers on a screen.

An arms expert and journalist, **Vasily Sychev** (Russian Federation) writes for publications including the *Rossiyskaya Gazeta* newspaper, *Expert*, the Russian weekly business magazine, *Lenta.ru*, an independent Russian news site, and the *Military-Industrial Courier*, a defence newspaper. He also heads the "Arms" and "Aviation" sections in the popular science web journal *N + 1*.



Working for, not against, humanity



**Tee Wee Ang and Dafna Feinholz
(UNESCO)**

As we head inexorably towards an automated future and the almost infinite possibilities of artificial intelligence (AI), it is imperative that we identify the ethical implications of this emerging technology and address the unprecedented legal and social challenges that arise.

The end of privacy in the digital age?
Work by Cuban cartoonist Falco.

© Falco / Cartoon Movement

Every once in a while, we encounter a technology that gives us pause to consider what it means to be human. The advent of AI requires us to engage in deep reflection on its potentially far-reaching impacts. Although the concept behind this technology has been in our collective imagination for decades, it is only now becoming an entrenched reality in our lives.

Recent advances in AI technology – especially those related to machine learning in general and deep learning in particular – have shown that AI-enabled systems can outperform humans in terms of efficiency and effectiveness in many areas, including tasks that require some degree of cognitive reasoning. As such, AI has the potential to bring about tremendous progress and benefits for humanity, while at the same time creating disruptions in the current socio-economic and political arrangements of human society.

When we think about the ethical implications of AI, we should be realistic about what AI is and is not, today. Generally, when we talk about AI we are referring to “narrow AI” or “weak AI”, which is designed to accomplish a specific task – such as analysing and improving traffic flow; making online recommendations of products, based on previous purchases, etc. Such “narrow AI” is already here – and will become increasingly complex and integrated into our daily lives.

For now, we are not considering what is termed “strong AI” or Artificial General Intelligence (AGI) depicted in many science-fiction stories and movies – which would purportedly be able to accomplish the full range of human cognitive tasks, and some experts argue, would even include traits of “self-awareness” and “consciousness”. Currently, there is no consensus on whether AGI is feasible, let alone when it will be achieved.

Never-ending data collection

Machine learning and deep learning approaches require a large amount of historical and real-time data for an AI-enabled system to “learn” from “experience”, and an infrastructure for an AI to implement its goals or tasks, based on what it has learnt. This means that when we consider the ethical implications of AI, we must also take into account the complex technological environment that is required for AI to function. This environment includes the constant collection of big data through the Internet of Things; the storage of big data in the cloud; the use of big data by AI for its “learning” process; and the implementation of AI’s analyses or tasks through smart cities, autonomous vehicles, or robotic devices, etc.



© Max Aguilera-Hellweg / INSTITUTE

Geminoid F and anonymous model, an installation by American photographer and director, Max Aguilera-Hellweg.

The more complex technological development becomes, the more complex the ethical questions raised will be. While the ethical principles do not change, the ways in which we address them can change radically. As a result, these principles could be severely compromised, knowingly or unknowingly.

Our notions of privacy, confidentiality and autonomy, for example, could change radically. Through smart devices and apps that have become instruments of social networks like Facebook and Twitter, we are “freely” and willingly giving out our personal information, without properly understanding the potential uses of this data and by whom. This data is then fed into AI-enabled systems that are primarily being developed by the private sector.

This data is not anonymized, so that the information about our preferences and habits can be used to create patterns for behaviour that allow an AI-enabled system to deliver political messages, sell commercial apps, keep track of some of our health-related activities, etc.

The best and the worst

Would this mean the end of privacy? What about data security and vulnerability to hacking by criminals? Could this data also be co-opted by the State to control its population, perhaps to the detriment of the individual’s human rights? Would an AI-enabled environment that constantly monitors our preferences and provides us with a range of options based on those preferences, limit the extent of our autonomy of choice and creativity in some way?

Another important question to consider is whether the data that is being used by an AI-enabled system to learn contains embedded biases or prejudices, which might lead the AI to make decisions that result in discrimination or stigmatization. AI systems tasked with social interactions or the delivery of social services would be particularly vulnerable to this. We must be cognisant of the fact that some data, such as that generated on the internet, contains information that reflects both the best and the worst of humanity. Therefore, relying on an AI-enabled system to learn from this data is itself insufficient to ensure an ethical outcome – direct human intervention would be necessary.

Could an AI-enabled system be taught to be ethical? Some philosophers argue that some experiences – such as aesthetics and ethics – are inherent to human beings, so they cannot be programmed. Others propose that morality can be enhanced through rationality, and therefore can be programmed, but free choice must be respected.



“ Could data also be co-opted by the State to control its population, perhaps to the detriment of the individual’s human rights? ”

There is currently no consensus about whether ethics and morality can be taught even to humans, based only on rational thinking, let alone to an AI. Even if an AI was eventually programmed to be ethical, whose ethics would we use? Would they only be the ethics of the developers? Given that the development of AI is primarily driven by the private sector, it is imperative to consider the possibility that the ethics of the private sector could be inconsistent with the ethics of society.

If we are to ensure that AI works for, instead of against us, we must engage in a comprehensive dialogue that includes the different ethical perspectives of everybody affected by it. We must make sure that the ethical framework we use to develop AI also takes into account the larger questions of social responsibility, to counterbalance the potential disruptions to human society.

Programme Specialist, Bioethics and Ethics of Science at UNESCO, **Tee Wee Ang** (Malaysia) worked in design engineering and engineering management before joining UNESCO in 2005.

Chief of Section, Bioethics and Ethics of Science at UNESCO, **Dafna Feinholz** (Mexico) is a psychologist and bioethicist by training. She was formerly Secretary General of Mexico’s National Commission of Bioethics.

The ethical risks of AI

Marc-Antoine Dilhac, interviewed by Régis Meyran

Artificial intelligence (AI) can be used to increase the effectiveness of existing discriminatory measures, such as racial profiling, behavioural prediction, and even the identification of someone’s sexual orientation. The ethical questions raised by AI call for legislation to ensure that it is developed responsibly.

What are the issues raised by behaviour analysis software based on filmed images?

AI helps to improve the preventive use of video surveillance systems in public places. Images are now being continuously analysed by software that detects acts of aggression and can quickly raise the alarm. This new system is being tested, for example, in the corridors of the Châtelet station in the Paris metro system. If we accept the principle of video surveillance, the only problem with the use of AI is the risk of error. And this risk is not very high, since it is humans who must take the final decision whether or not to intervene.

Nevertheless, facial recognition errors are very common. All it takes is one small glitch in the image for the AI to see a toaster instead of a face! The feeling of excessive surveillance and the multiplication of errors can be particularly worrying.

There is also cause for concern that these intelligent systems and the racial and social profiling techniques they might use, could lead to abuses.

What kinds of abuse are you referring to?

I’m thinking in particular of the programmes, already being used in several countries, to identify “terrorist behaviour” or “criminal character”, using facial recognition. Their facial features would therefore be used to indicate their intrinsic criminal tendencies!

Alarmed by this resurgence of physiognomy, Michal Kosinski and Yilun Wang of Stanford University in the United States, wanted to expose the dangers of this pseudo-scientific theory – thought to have been relegated to history – which claims to study a person’s character, using facial recognition. To draw attention to the risks of invasion of privacy, they created an “AI gaydar” in 2017 – a programme to identify whether someone is homosexual or not, only by analysing their photograph! According to the authors, the margin of error for the programme is only twenty per cent. In addition to its stigmatizing effect, the application of this technology would violate the right of everyone not to disclose their sexual orientation.

Any scientific research that is carried out without philosophical guidelines or a sociological or legal compass is likely to raise ethical problems. The few examples I have mentioned show the urgent need to establish an ethical framework for AI research.

What about eugenistic abuses?

In my opinion, AI is not a priori a factor of eugenics. Some people prophecy a world in which humans can be improved through the use of AI – chips to expand memory or improve facial recognition, etc. While intelligent robotics might be able to offer medical solutions for some forms of disability (such as providing mobility through sophisticated prosthetics), the transhumanist hypothesis of the augmented man remains in the realm of science fiction.

Assistant professor in ethics and political philosophy at the University of Montreal, **Marc-Antoine Dilhac** (France) holds the Canada Research Chair in Public Ethics and is co-director of ethical and political research at the Centre for Research on Ethics (CRE).



AI and literature: is it really all for the best?

Karl Schroeder, interviewed by Marie Christine Pinault Desmoulin (UNESCO)

Karl Schroeder devotes his time to reading, studying, observing and imagining futuristic stories. Internationally renowned as one of the stars of science fiction, his books have inspired experts in new technologies and artificial intelligence (AI). In addition, he puts his imagination to work for companies and governments, to help them anticipate their technological, economic and social transformation. For the Canadian novelist and essayist, AI is more a cultural than a technological revolution – one that requires reflection on ethical, governance and legislation issues.

Besides your passion for digital and technological innovations, what are your sources of inspiration?

I devote a substantial part of my time to reading great philosophers. This allows me to have an overview, to consider the possible connections between technologies and societal movements. But, let me reassure you, I give just as much attention to the plot, so that my books are entertaining!

At the same time, the internet is an infinite source of information and distraction. Any navigation on the network is an opportunity for new discoveries that may encourage me to rethink, or even to change radically, everything I have just written. The internet really makes my research easier and I take only the best from it.

Do you foresee that AI could one day replace you as a writer?

At this time, I would equate the contribution of AI in my field to a randomization function, comparable to laying out a deck of cards, each of which could define a character, a scene, etc. For example, one of them could be "the king of the bad guys, he is next to a tower" and from there, I could develop a character, a plot.

I believe that creativity could eventually happen outside of human beings. So I can imagine that AI will be able to create a book worthy of the name, but certainly not in its current form. These will be different kinds of machines, which we have not yet thought up.

Today's computers do not produce meaning, and human intervention is always necessary in the creative process, even if technological devices are becoming more refined and approaching human capabilities.

In my novel, *Lady of Mazes*, there is a scene where AI is going insane and sets up a kind of creativity bomb that fuels millions and millions of novels of exceptional quality, literally too many for people to read in all their collective lifetimes! And so, what happens to humans? Well, they adapt and continue their own creation.

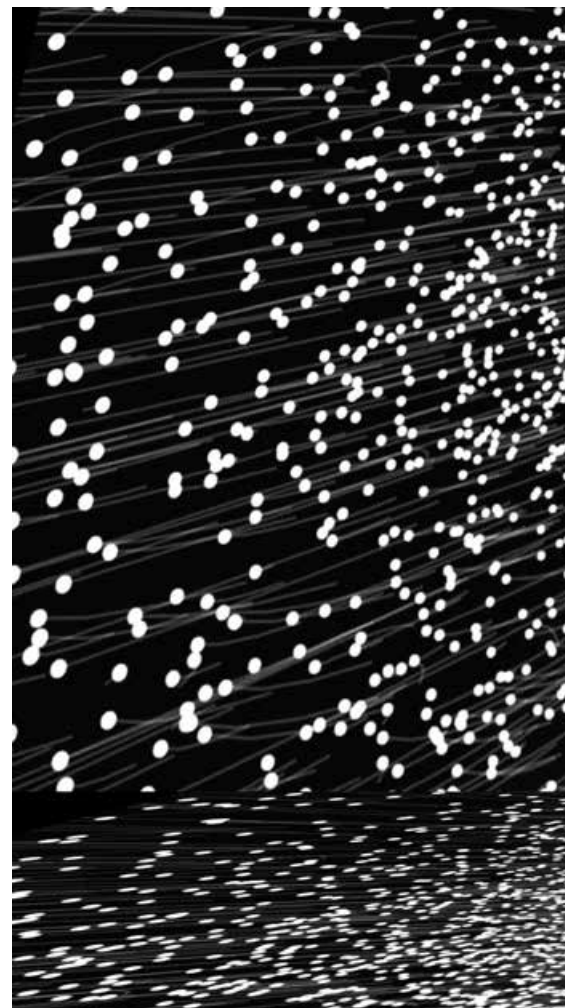
Imagine that this creative bomb were to explode today. Why would that prevent me from continuing to write new books? Why should I think "me *against* a million books" and not "me *and* a million books?" I consider creativity – whatever its origin – an addition, and not a subtraction, to our own existence.

In fact, the notion of replacement is inherent in the concept of value. We could consider that everything can be replaced, according to a given value. As a writer, I could be replaced by a computer that has more commercial success than me. But this reasoning is only valid if commercial success prevails in the value system.

Does this mean you have no apprehensions about AI?

Determining whether AI is a threat or a benefit is entirely a human responsibility. There are many simplistic ideas about AI, how it works, and why it could be a threat to humanity. One could even say that there is an exaggerated anxiety focused on losing control of the machine. At the stage where we are today, this is not an effective way of thinking.

On the other hand, it is imperative to choose the direction that AI will take and to decide how it will be used. If we decide to invest in supermachines for economic or political warfare, we are taking the path of building a hostile environment, of course. Society must make the right decisions for the implementation of AI.





“ Ethics? Science fiction has been thinking about all this for a century! ”

If one day the products of AI become independent of us, they will be like the children who leave us when the time comes, to lead their own lives! Our responsibility as parents is to nurture them and to instil positive values. This is the cornerstone of the argument.

Is this related to the question of ethics?

Yes, science fiction has been thinking about all this for a century! Policymakers and society are only just beginning to think about these issues. It's because we aren't seriously examining the subject that we resort to free-wheeling every time a major technological innovation is introduced. Even so, the solution is simple – we must decide to implement a new technology only after having identified its social impact, determined its use and legislated accordingly.

I made this issue one of the messages in *Lady of Mazes* – to encourage us to plan the implementation of any technological innovation, to better anticipate societal changes.

What will be the message of your next book?

It will undoubtedly deal with the future of politics and decision-making processes, and also the technological means that could take us to another level of civilization.

That's a joke, but I am thinking of writing it with a pen! It will be an experiment of use, just like the ones that digital tools offer us. We must be able to distinguish writing from the means of writing. Technology is only a means, and it must be put back in its proper place. There is nothing we need to give up about what we are or what we want to be – we only have to prepare ourselves collectively.

A science fiction novelist, essayist and futurist, **Karl Schroeder** (Canada) is the author of ten novels, translated into as many languages. They include *Ventus* (2000), *Permanence* (2002), *Lady of Mazes* (2005), *Crisis in Zefra* (2005) and *Lockstep* (2014). He received the Netexplo Talent Prize at UNESCO in February 2018.

Scene from Poetic_AI, called the world's biggest AI exhibit, created entirely by an algorithm. The Istanbul-based new media agency, Ouchhh, created an AI to visualize countless stories, books and articles, about 20 million lines of text – all written by scientists who changed the world – to create this 17-minute installation.



© Ouchhh



Learning to live **in the time of AI**

Leslie Loble

To the three basic pillars of any education system – reading, writing, arithmetic – we must now add three others: empathy, creativity and critical thinking. These skills, usually acquired outside school, must be included in school curricula, as artificial intelligence (AI) becomes part of our societies.

In Australia, 300,000 children begin their school journey this year, in 2018. Graduating from school in 2030, they will spend most of their working lives in the second half of the twenty-first century – some may even live to see the dawn of the twenty-second century. The pace of change wrought by advancing technologies makes it increasingly likely that these children will live and work in a world that is radically different from ours. Education systems must move swiftly to anticipate and adjust to this change if these future generations are to thrive.

New South Wales is the largest school education sector in Australia, with over a million children and young people attending some 3,000 schools. In every classroom, every day, a teacher instructs and guides these students toward their future. But at a system level, especially one of this scale, change can be slow to evolve, even with the mounting and clear urgency that new technology brings.



© Vincent Fournier

This is why the New South Wales (NSW) Department of Education initiated Education for a Changing World in 2016. Examining the strategic implications of technological advances, this comprehensive project aims to stimulate and inform necessary reforms in curricula, teaching and assessment, and to orient the entire system towards a more innovative approach.

Since the project began, the Department has engaged with global leaders from the economic, technology and academic spheres, deliberations which led to the publication of *Future Frontiers: Education for an AI World* in November 2017. The book explores the future of education in a world with AI, and the skills needed to thrive in the twenty-first century.



Some of these thought leaders got together with educationalists, non-government organizations (NGOs) and policymakers at an international symposium in late 2017 to discuss how to use new technologies and tools to support teachers and improve student outcomes. The infusion of new ideas led to a unified commitment to reform.



Photo by French fine art photographer Vincent Fournier, taken in Barcelona, Spain, in 2010, as part of The Man Machine series, showing "speculative fictions", where artificial creatures interact with humans.

The new Rs

The three Rs – reading, writing and arithmetic – are the foundation of all learning, but today's students need additional core skills and important non-cognitive skills such as self-efficacy. The pace and breadth of technological change demands a deeper understanding of concepts, and a great deal of resilience, adaptability and flexibility for students, teachers and education systems as well.

Human skills will be more important than ever in the new world taking shape before our very eyes – critical thinking will be one of the most powerful skills that education systems will impart to students.

For the time being, these essential skills can be acquired through extra-curricular activities, where we learn about cooperation, goal-setting and planning, for example. Discipline and team spirit could be developed through sports, creativity through drama, critical thinking through debate, and empathy through fundraising for the Red Cross or volunteering at a youth group.

The challenge is how to create this wide range of opportunities for all students, how to value them as legitimate experiences and integrate them into our curricula, and how to assess students in these domains – which were previously not considered part of school education.

One thing is certain – the future will demand that children develop connections with one another and foster a sense of community, citizenship and collaboration based on empathy, which some believe is a key competency for the twenty-first century.

Interpersonal competencies are increasingly recognized as a crucial component for education systems around the globe. Organizations including UNESCO and the Organisation for Economic Co-operation and Development (OECD) are developing frameworks, standards and assessments for intrapersonal competencies, and concepts such as global skills to support greater cross-cultural collaboration. In Australia, a set of general capabilities including critical and creative thinking and intercultural understanding were included in the national curriculum in 2009 – since then, many jurisdictions have added them to their own curricula.

The Education for a Changing World project has highlighted the imperative to foster innovative education practices that will lead to widespread gains across the system.

Already, these novel practices are springing up across the education community, seeking to motivate, engage and challenge students, and to harness the potential of advanced technology to lift their performance. Some of these practices have a stronger evidence base than others, which makes it difficult to distinguish which ones are the most effective.

AI in the classroom

Drawing on lessons from national and international innovation best practices within the private and public sectors, the NSW Department of Education is examining how to better support educationalists to develop and accelerate innovative ideas. The aim is to establish new ways to create sustainable and scalable methods to extend the learning, capabilities and achievements of our students.

AI offers significant potential within education, if used wisely and if it serves the needs of educators. Already, there are AI-based systems that can support personalized learning, freeing up teachers to focus on individual student needs and educational leadership. These systems are able to monitor student engagement and progress, and potentially suggest adjustments to content.

It is crucial that educators are in the driver's seat when it comes to designing and developing AI-based systems. Teachers and school leaders must play a critical role in defining a clear purpose for AI in the classroom, and be trained to understand and utilize it effectively. Students must also be involved in decisions about the use of these technologies and educated about the ethical frameworks that accompany their use. Their future will depend on the policies and approaches that are adopted now.

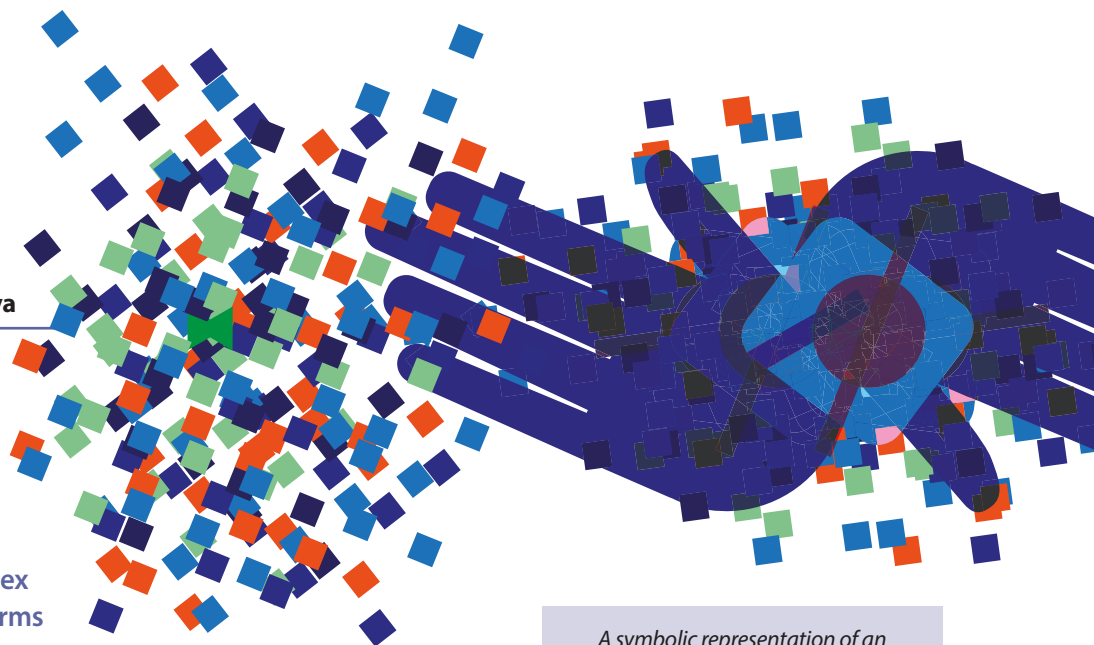
Deputy Secretary in the New South Wales Department of Education, **Leslie Loble** (Australia) has led strategy, reform and innovative delivery in Australia's largest and most diverse education sector for nearly two decades. She was awarded the *Australian Financial Review*/Westpac Top 100 Women of Influence in 2013 for her positive impact on Australian public affairs and in recognition of her role in education reform.

“Making the most of artificial intelligence”

Audrey Azoulay

Audrey Azoulay,
Director-General of UNESCO,
 interviewed by Jasmina Šopova

Artificial intelligence (AI) could help humanity overcome many of the serious social problems it faces. But at the same time, AI presents a series of complex challenges, particularly in terms of ethics, human rights and security. Yet, no international ethical framework that applies to all AI’s developments and applications currently exists. An international regulatory tool is indispensable.



A symbolic representation of an AI cooperating with humans.

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Why is UNESCO interested in AI?

The experts are unanimous: humanity is on the threshold of a new era. Artificial intelligence will transform our lives to an extent that we cannot imagine. This transformation has already begun and it affects all aspects of our lives. AI has many applications in fields as varied as health, education, culture, security, defence, etc. Research has increased considerably in recent years: the giants of the web, FAMGA, but also many countries, are now investing massively in AI, and becoming actors of this “Fourth Industrial Revolution”.

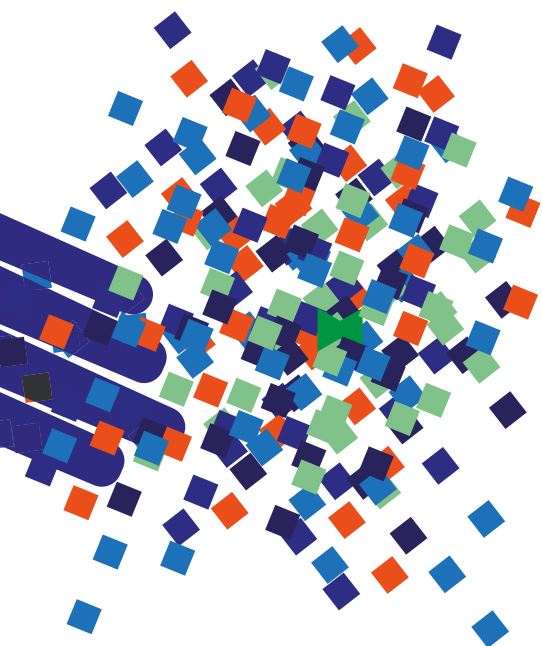
UNESCO has a significant role to play in these changing times. First, because AI’s applications directly affect the Organization’s areas of expertise. Education will be profoundly transformed by AI. Teaching tools, ways of learning, access to knowledge, and teacher training will be revolutionized.

The question of what skills to develop in order to evolve in an increasingly automated world will become more and more central.

In the field of culture, AI is already widely applied: for example, 3D imaging is used for heritage reconstruction – as we will do for the old city of Mosul in Iraq. In the sciences too, particularly in our environmental programmes and in underwater research – for the classification of plankton images or the automatic detection and census of cetaceans and seabirds, for example. Communication and information are also directly dependent on advances in AI. UNESCO must lead this reflection on the benefits and risks of AI in education, culture, science and communication and information.



“UNESCO has a significant role to play in these changing times. AI’s applications directly affect the Organization’s areas of expertise”



What are the risks, in your view?

In general, AI can be a fantastic opportunity to achieve the goals set by the 2030 Agenda, but that means addressing the ethical issues it presents, without further delay. An opportunity, because its applications can help us to advance more rapidly towards the achievement of the Sustainable Development Goals (SDGs) – by allowing better risk assessment; enabling more accurate forecasting and faster knowledge-sharing; by offering innovative solutions in the fields of education, health, ecology, urbanism and the creative industries; and by improving standards of living and our daily well-being. But it is also a threat, because automation and digitization create new imbalances. They can decrease diversity in cultural industries, disrupt the labour market, create job insecurity and increase disparities between those who have access to these new technologies and those who are deprived of them.

This is where UNESCO also has a role to play – in trying to reduce the inequalities in access to knowledge and research – through the support it provides to its Member States. The technological divide is likely to have a multiplier effect on social inequalities. UNESCO must be able to help its Member States adapt to new realities and access technological knowledge.

How can UNESCO provide this support, concretely?

One of the challenges for Member States is to have sophisticated, cutting-edge engineering materials and adequate human resources – scientists and engineers. Through its Centres for Education and Training in Science, Technology and Innovation (STI), its Global Observatory of Science, Technology and Innovation Policy Instruments (GO-SPIN) and its International Basic Sciences Programme (IBSP), UNESCO is in a position to provide such support – and to help reduce disparities between countries.

What are the challenges posed by AI in education? How does UNESCO intend to respond to these?

This is, of course, a key area for the Organization. Here again, the revolution that is now underway is generating both positive and negative effects.

Educational software based on AI is already being used to decentralize teaching and personalize it, and to provide students with curriculum advice, or even certification. But these technologies are expensive and therefore inaccessible to the great majority – the gap between rich and poor is likely to widen even further.

Robots and Ethics

The COMEST Report on Robotics Ethics, 2017

Robotics today is increasingly based on artificial intelligence (AI) technology, where robots are endowed with cognitive or human-like abilities such as perception, the use of language, interaction, problem-solving, learning and even creativity. The main feature of these cognitive robots is that their decisions are unpredictable, and their actions depend on stochastic (random) situations and on experience.

This is very different from deterministic robots, whose behaviour is determined by the programmes that control their actions. The question of accountability of the actions of cognitive robots is therefore crucial – especially as these have an impact on human behaviours, induce social and cultural changes, and raise questions about safety, privacy and human dignity.

In its *Report on Robotics Ethics*, published in November 2017, UNESCO’s World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) proposes a technology-based ethical framework for developing recommendations on the ethics of robotics – based on the distinction between deterministic and cognitive robots.

The report further identifies ethical values and principles that could help establish regulations in the robotics field, at all levels and in a coherent manner – ranging from codes of conduct for engineers to national laws and international conventions. The values and principles highlighted include human dignity, autonomy, privacy, safety, responsibility, beneficence and justice. The principle of human responsibility is the common thread that links the different values examined in this report.

COMEST also makes a series of specific recommendations concerning the application of robotic technologies. These include the further development of codes of ethics for roboticists, and warnings against the development and use of autonomous weapons.



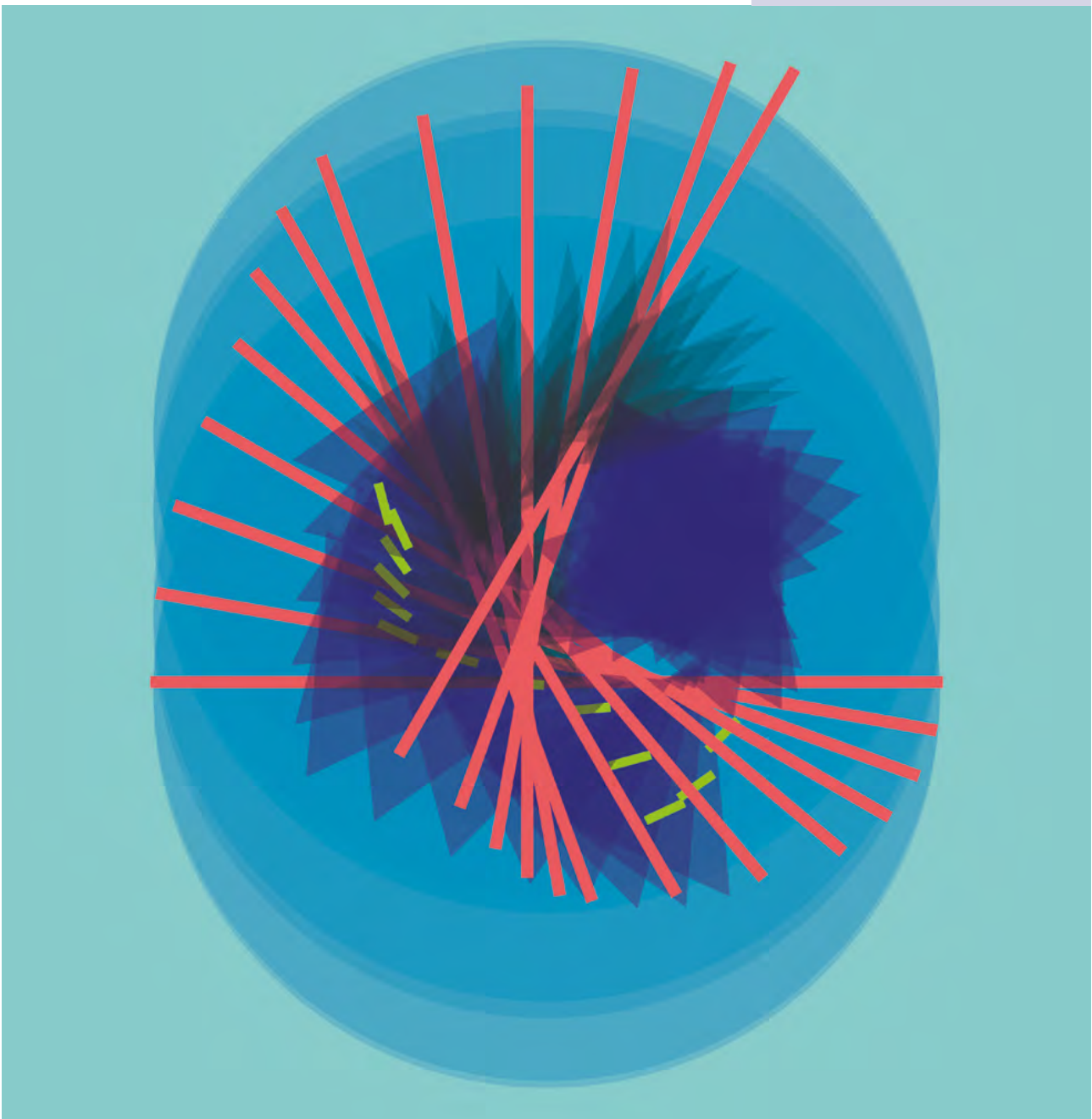
“It is our responsibility to enter this new era with our eyes wide open”

As a result of its coordinating role in the SDG-Education 2030 Steering Committee to monitor the achievement of Sustainable Development Goal 4, dedicated to education, UNESCO is in an excellent position to lead this work – by identifying the possible contributions of AI to inclusive education and assessing its potential impact on the future of learning.

Promoting open-access AI tools that will encourage local innovation will be one of our priorities.

To prepare future generations for the new landscape of work that AI is creating, it will also be necessary to rethink educational programmes, with an emphasis on science, technology, engineering and mathematics – but also giving a prominent place to the humanities and to competencies in philosophy and ethics.

We need to prevent the misuse of AI.



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What is the relationship between AI and philosophy or ethics?

In their adult lives, today's schoolchildren and students will undoubtedly have to face problems that are currently unfathomable to us. It is difficult to predict all the possible developments of these increasingly sophisticated machines that are gaining a little more autonomy each day – to the point of already challenging human identity, to a certain extent. This is why skills in ethics, but also in the social sciences and the humanities in general, will be just as important as those in the formal sciences. There may also be embedded biases – including gender biases – in AI systems, that require more transparency from these systems and strong ethical principles to correct them.

Why is it difficult to predict future developments in AI?

Research in the field of AI is advancing at a very rapid pace, while the legal, social and ethical environments that are needed to guide it are evolving very slowly. How far can a machine's autonomy and its decision-making power be allowed to go? If an accident occurs, who is responsible? And who decides what values are instilled in machines during what is called their "training"? These and many other questions remain unanswered today.

It was noticed, for example, that algorithms trained in ordinary human language had acquired prejudices based on stereotypes from textual data present in our everyday culture. How can we not be concerned about the danger of the emergence of machines with discriminatory, racist or hostile behaviours?

There are also many other reasons to be concerned about – privacy protection and targeted advertising on the internet; freedom of expression and censorship algorithms; automated journalism and information monopolies, etc.

Even if fundamental research in this field is largely motivated by well-being, unintentional, but also intentional, deviations are always possible. That is why it is imperative to ensure that this technology develops according to rigorously established ethical standards.

Whose AI is it anyway?

Human Decisions: Thoughts on AI, 2018.

With the phenomenon of big data and the transition of deep learning mechanisms, artificial intelligence (AI) has become one of the most talked-about technological trends, because of its repercussions on people and cultures.

The technological aspects of AI are fascinating, but some fear that AI may eventually eclipse human intelligence. Even if we accept the idea that AI will help the advance of humanity, we must anticipate the dangers if humans lose control of the technology, and be aware of the ethical implications of this.

Netexplo, an independent observatory which works in partnership with UNESCO, is carefully scrutinizing this vast subject – which encompasses philosophy, mathematics, science, computer science and engineering. In 2015, UNESCO and Netexplo created a common Advisory Board (UNAB) – a network of professors, lecturers and researchers from the world's leading universities to analyse trends in digital technology, and AI in particular.

In 2018, UNAB published *Human Decisions: Thoughts on AI*, a collection of analyses that aims to stimulate thinking on the critical challenges of AI and understand their key workings.

One pervasive concern that is examined from different perspectives across the book is whether humans deliberately entrust their decision-making powers to the AI. Is the AI a substitute for humans? What are the potential measures to safeguard us from the abuse of AI? These questions are discussed in addition to the points of view developed by Netexplo, by comparing different scenarios.

Beyond these perspectives, the question about decision-making recur in a haunting way. Have we already given up the authority of controlling the machine? What if the AI ends up controlling the behaviour of humans without their participation? In this case, who, or what, will be in charge of the decision-making?

While some experts fear that the influence of AI could lead us to an interconnected system where our own intelligence is subordinated to that of machines, others remain convinced that our current level of the knowledge of computer science is too limited to justify such a fear of the unknown. According to the latter group, it is not a question of competition, but of cooperation, between AI and humans.

What can UNESCO do in this regard?

If we are to make the most of the possibilities offered by AI to the world, we must ensure that it serves humanity, with respect for human dignity and human rights.

Yet, no international ethical framework that applies to all AI developments and applications currently exists.

UNESCO is this unique universal forum with over twenty years of experience in developing international instruments related to bioethics and the ethics of science and technology*. It can also rely on the expertise of two advisory bodies working actively on these issues: the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) and the International Bioethics Committee (IBC).

It is our responsibility to lead a universal and enlightened debate – not a technical debate, but an ethical one – in order to enter this new era with our eyes wide open, without sacrificing our values, and to make it possible, if Member States so wish, to establish a common global foundation of ethical principles.

* *Universal Declaration on the Human Genome and Human Rights (1997)*

International Declaration on Human Genetic Data (2003)

Universal Declaration on Bioethics and Human Rights (2005)

Declaration of Ethical Principles in relation to Climate Change (2017)

Recommendation on Science and Scientific Researchers (2017)



A lexicon

for artificial intelligence

The terms marked with an asterisk are defined in this glossary

Algorithms

The word is derived from the name of the ninth-century Persian mathematician, Muhammad ibn Musa al-Khwarizmi, who introduced decimal numbers to the West. Today it means a series of instructions that must be executed automatically by a computer. Algorithms are at work in all areas, from search-engine queries and the selection of information suggested to internet users, to financial markets.

Artificial life

An interdisciplinary field of research that aims to create artificial systems inspired by living systems, in the form of computer programmes or robots.

Augmented man

A transhumanist* ideal, the augmented man is an individual who has been subjected to modifications aimed at enhancing his performance, thanks to interventions on the body based on scientific or technological principles. Part-man, part-machine, the individual would be able to run faster, see well in the dark, withstand pain, possess enhanced intellectual abilities, resist illness or death, etc. The “repaired man” already exists and “connected” prostheses are getting better every day. The augmented man is gradually becoming a reality, with the development of artificial external skeletons used for military purposes.

Augmented reality

The superimposition of virtual elements onto reality, calculated by a computer system in real time (such as sounds, 2D and 3D video images, etc.). This technique is used in video games and cinema, where the spectator interacts with virtual objects through sensors. It is also used for geolocation and heritage applications. For instance, the Cluny Abbey in France uses augmented reality screens, so visitors can visualize the town as it was in the fifteenth century.

Big data

A set of digital data that, through its volume, surpasses human intuition and analytical abilities. We generate some 2.5 trillion bytes of data every day on the internet, through emails, videos, weather information, GPS signals, online transactions, etc. No traditional computerized database management tool can process this mass of data – it has required the development of new algorithms* to store, classify and analyse it.

Bioconservative

For transhumanists,* people who criticize their ideal, augmented man are bioconservatives – regressive individuals who refuse to change the laws of life and nature, even though technology makes it possible to do so.

Cloud

Different computer systems involving a large number of computers connected to each other, and exchanging messages in real time over the internet. A calculation or the storage of information launched by one computer can therefore be carried out by a network of interconnected computers – thus creating a cloud.

Deep learning

At the cutting edge of machine learning*, this technique enables a machine to independently recognize complex concepts such as faces, human bodies, or images of cats. This is done by scouring millions of images picked from the internet – images that have not been labelled by humans. The result of a combination of learning algorithms and formal neural networks* and the use of mass data, deep learning has revolutionized artificial intelligence.

It has countless applications, including search engines, medical diagnosis, autonomous cars, etc. In 2015, the AlphaGo computer used deep learning to beat humans at Go, the ancient Chinese board game.

Formal neural networks

These are algorithms designed to be implemented by a computer, which aims to replicate the neural connections of the brain. Existing systems are much more limited than human intelligence. But they are still capable of estimating the speed of a vehicle according to movements of the accelerator pedal and the slope of the road; the hardness of a material as a function of its chemical composition and its processing temperature; or the solvency of a business according to its turnover, etc.





Human cryogenics

The technique for the conservation of a human body or head in liquid nitrogen, after an individual's death, with the aim of resuscitating it one day.

Hybridization between humans and machines

This process allows a connection between the human body and a technological system. The connection can be physical, like a mind-controlled prosthetic arm, or virtual, like Google glasses, which are voice-controlled and which display information or images in a corner of the lenses that are superimposed on our usual vision.

Immersive virtual reality

A virtual, computer-generated universe, into which the user is immersed via various sensors or objects (glasses, sensory feedback suits, etc.). Immersion in virtual reality may involve the player of a video game or an aircraft pilot in training.

Internet of Things

A computing concept that describes the idea of everyday objects or places in the physical world that are connected to the internet, and are able to identify themselves to other devices. A connected object gathers data (temperature, speed, humidity, etc.) through sensors, and sends it, via the internet, for computer analysis. The object might be a vehicle, a watch, an industrial machine or even a parking space.

Machine learning

A machine uses an automatic learning programme to solve problems from examples, enabling it to compare and classify data, and even recognize complex shapes. Before the advent of deep learning* in 2010, this type of programme needed to be overseen by humans – each image had to be explicitly designated as containing a human face, a cat's head, etc., so that the machine could perform the requested recognition operation.

Mind uploading

According to transhumanists*, our sensations, thoughts and emotions can all be summed up as neural connections.

Mind uploading is the transhumanist idea that the “contents” of the human brain can be reduced to a set of information that could be translated into binary computer code, and thus uploaded into a computer.

Neo-connectionism

A theory arising from the fields of cognitive science and neuroscience, neo-connectionism proposes to develop computer models that aim to simulate learning by formal neural networks*, the organization and functioning of which have been designed by analogy with physiological neural systems.

Semantic knowledge representation

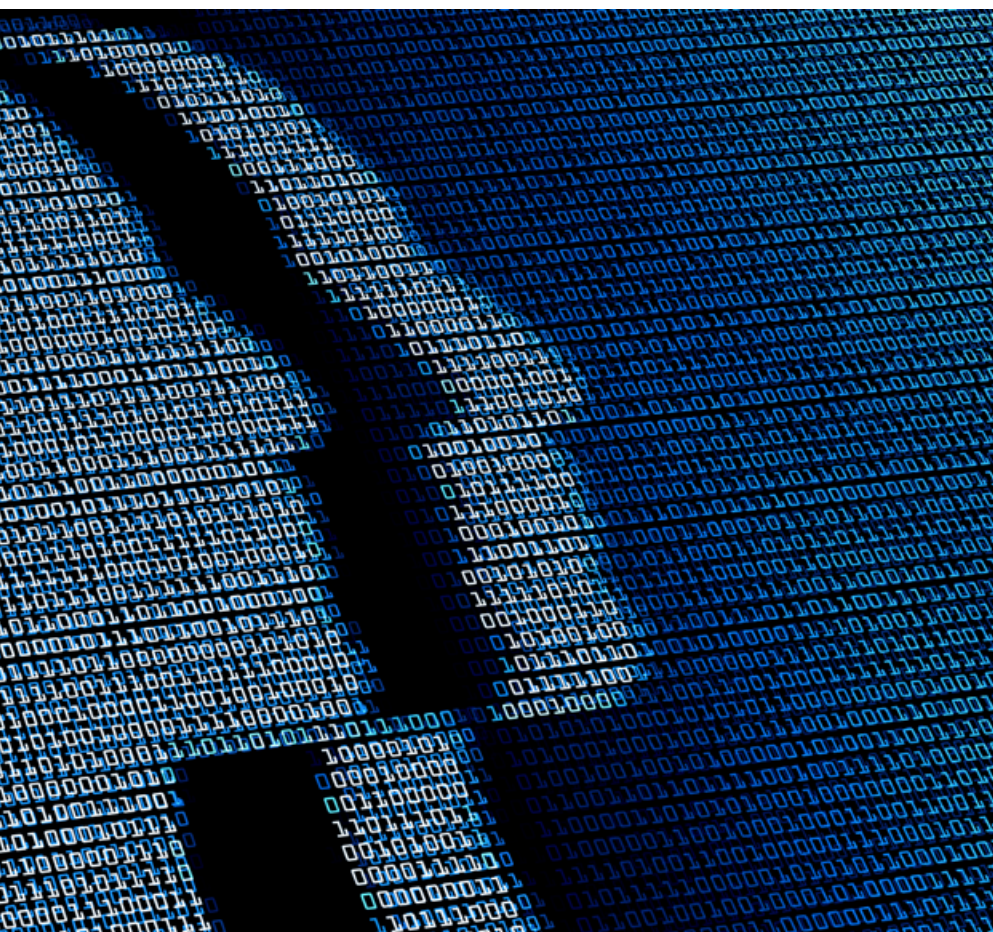
Algorithms* to formulate a sentence written in any language (for example, “Paul takes the bus to Berlin”) in logical form, so that a computer is able to interpret it. The machine can then make logical inferences (like deductions) that enable it to classify words into different categories and analyse the sentences submitted to it.

Transhumanism

A movement whose followers want to reach the “post-human” condition by eliminating disabilities, suffering, illness, ageing and death, through the “NBIC convergence” (the convergence of nanotechnology, biotechnology, information technology and cognitive science). They promote the use of human cloning, virtual reality*, hybridization between humans and machines and mind uploading*. Their opponents accuse them of excessive speculation, of founding a new mystical order which idolizes technology, and of fantasizing about a “superhuman” with eugenicist overtones.

Weak AI/ Strong AI or Artificial General Intelligence (AGI)

Weak AI or Artificial Narrow Intelligence (ANI) is the only form of AI that humanity has achieved so far – machines that are capable of performing certain precise tasks autonomously but without consciousness, within a framework defined by humans and following decisions taken by humans alone. Strong AI or AGI would be a machine that has consciousness and feelings, and is capable of providing solutions for any kind of problem – that is pure fiction, for now.



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Zoom



In Tana Toraja, on the Indonesian island of Sulawesi, ancestors are represented by buffalo horns fixed to the front of the house – a sign of family wealth. Putrie demonstrates her heritage symbolically.



How much can you carry?

Photos: Floriane de Lassée

Text: Sibylle d'Orgeval

Along the asphalt strips, on the endless dirt roads, where the haze of heat shrouds the horizon, improbable silhouettes walk. From East Africa to the far reaches of the Himalayas, the bodies of these walkers are extended vertically by a stack of things – indistinguishable for those who pass them in cars, the drivers too preoccupied by the road, and trying not to knock them over. Whether the torso is straight or bent over by the weight, the head is always held high, oblivious of the rickety old cars speeding by. Modern-day caryatids!

On the other side of the window, caught up in a hurried world that scorns the slow pace of the porters, we are mere spectators of these lives that pass by. But Floriane de Lassée, traveller and photographer, decided to stop rushing, to take the time to meet them – only to discover that these balancing artists are carrying much more than just a can, a jug or a bag of clothes; much more than they need to survive. They carry the weight of life.

Her series, called *How much can you carry?* is actually a question posed as a challenge: "Show me how much you can carry! Show me who you are!"

A question to which the French photographer responds with humour and depth. Who would have thought that a little girl could carry a stack of firewood on her head with a young goat perched on top? Are we stronger than we think we are? Do these objects just rest on their heads, or do they emerge from them, as if they were the expression of their unconscious, as if suddenly the "outside" illustrated what was "inside"? In Indonesia, on Putrie's head, is this mountain of horns, a symbol of power and wealth, real? Was it put there by the elders, who pass on this burden to her? Or did it emerge from a brain already well aware of her future responsibilities?



Barely out of breath, Mandebi climbs 2,500 metres on the trails of the Annapurna mountain in Nepal, with a load of fifty kilos on her head.

De Lassée takes the opposite view to the usual imagery of downcast heads and curved spines and goes beyond the cliché of the forced labourer, crushed by work. No matter what the load, the head is always proud and the smile, bright. As if, at the time when their photographs were taken, everyone was mocking destiny. Life is a balancing act, and Floriane's photos take us beyond all gravity! While contemplating so many loads carried with gaiety, let us imagine for a moment that we could play with our own burdens, and come away so much lighter!

The photo series *How much can you carry?* started in Ethiopia in 2012, and continues to grow. It is currently spread over four continents and ten countries, including Bolivia, Brazil, Indonesia, Japan, Nepal and Rwanda, and is represented in sixty photographs.



1
Freddy carries fresh water on Isla del Sol. Located in the middle of Lake Titicaca, Bolivia, the island desperately lacks drinking water.

2
In Nepal, Dokalia carries her bamboo bed, on which her body, weakened by age, will one day rest, as she departs for the hereafter.

3
Aru, a little Ethiopian girl, gets ready to walk for several hours to the market, where she will exchange her wood and kid goat for some basic necessities.

4
Gale, who belongs to Ethiopia's Hamar tribe, carries water – a commodity so scarce in the Omo Valley in the south of the country, that he has to carry a weapon to protect it.



4





2



3

1

In a small village in Rwanda, Casim runs a stall where he sells all kinds of things, including suitcases – fuelling dreams of journeys that will never be made.

2

Born in a fishing village near Fortaleza in Brazil, Nonato carries lobster pots to catch crawfish – lobsters are hard to come by these days.

3

Sary and Nifah sell coconuts to thirsty tourists, on the island of Sulawesi, Indonesia.

4

Yuzuke will work all his life at the naval shipyards of Onomichi, a port town along Japan's Seto Inland Sea.



4



Tamru, father of Aru (p. 44) and Aftam (p. 49) photographed in this series, carries dried cow-dung, which is used to insulate houses from the heat and cold.



Aftam, Aru's (p. 44) younger brother, will also make the long walk to the market to exchange his kid goat for necessities like wheat.



Ideas



*Aquí Estoy (Here I am, mixed media, 2014),
by Cuban artist Juan Roberto Diago*

© Juan Roberto Diago/ Courtesy Cernuda Arte

Dancing the unspeakable

or the question of how the memory of slavery influences contemporary artistic creation

Alain Foix

The artist Alain Foix takes a philosophical look at the relationship between history, memory and artistic creation. Thanks to his art, the artist is not assigned a skin colour and not irredeemably condemned to dance an unspeakable history. Instead, he is part of a dialectic: he is both free and possessed. By creating, he becomes the master of his own history, which allows him to overcome the past. His artistic intelligence must be seen as a “ruse” that produces a new influence on the world and, by creating an open and indeterminate work, encourages the sharing of cultures.

With this article, the *UNESCO Courier* marks the International Day for the Remembrance of the Slave Trade and its Abolition, on 23 August. Its first commemoration took place twenty years ago, in 1998, in honour of the 1791 insurrection in Santo Domingo (now Haiti and the Dominican Republic), which played a decisive role in the abolition of the transatlantic slave trade.

Influence: “the action by which a fluid flows from the stars, which is supposed to act on human destiny”. That was the original meaning of the word. According to the theory of universal gravitation, the stars exert an influence on each other according to their respective masses, and this influence is produced by gravitational waves which, in a certain way, correspond to the fluid of the Ancients.

We humans are therefore influenced, in a sense, by the very principle that nails us to the ground.

This idea of influence – passing from a cosmogonic, or mythical, conception, to a cosmological, or scientific, conception, and passing from astrology to astronomy – was revisited in the nineteenth century by the Bonapartist scholar, Pierre-Simon de Laplace, in the form of mechanical determinism. This determinism is illustrated by this famous sentence from his philosophical essay on probabilities: “We ought then to regard the present state of the universe as the effect of its anterior state and as the cause of the one which is to follow. Given for one instant, an intelligence which could comprehend all the forces by which nature is animated and the respective positions of the beings which compose it – an intelligence sufficiently vast to submit this data to analysis – it would embrace in the same formula the movements of the greatest bodies in the universe and those of the lightest atom; for it, nothing would be uncertain, and the future, as the past, would be present to its eyes.” In other words, we believe that we are free and autonomous subjects, even though we are the objects of the events that preceded us, and therefore remain under their influence.

But then, is it the effect of chance, or of an epistemological and ideological moment, that during the reign of Napoleon (1804-1815), and at the very moment when he restored slavery and deployed intensive colonization, other scholars, like George Cuvier, seize this deterministic conception, adopt it by applying it to the notion of human races, thus creating a scientific racism, in which scholars with dire reputations – like Gobineau, Friedrich Blumenbach, Houston Stewart Chamberlain and Vacher de Lapouge – engulfed themselves?



© Juan Roberto Diago/ Courtesy Cernuda Arte

Mi historia es tu historia (My history is your history, mixed media, 2000), by Cuban artist Juan Roberto Diago.

All of them confined these races in the historical determination of their constitutions.

And if “God does not play dice with the universe”, to use Einstein’s famous quote, there would be, in the order of this universal harmony, a logic in things – according to which there would be the chosen and the damned, visible and scientifically identifiable by their morphology. We know that it was such mechanistic thinking that encouraged the brutal mechanics of the industrial expansion of slavery.

Unfortunately, long after the abolition of slavery, and in spite of the progress of science in all fields of biology, anthropology and hard sciences like physics and astrophysics, this conception endures in our minds even today, and filters our cultural background. Have we not heard, on television and in the media, about the “curse of the Haitian people”, following the earthquake that struck Haiti in 2010 – thus associating a theological thought with a tectonic phenomenon linked to economic, political and social causes? As if the event remained under the influence of a past coming from some primal condition, whose cause is age-old. This obviously makes it possible not to take into account the colonial issue and the political and economic history which controls the destiny of this island even today.

Let us be wary, then, of the notion of influence, which, like a double-edged sword can wound those who wield it. Because not being wary could lead to this return of meaning that would imply we are determined – condemned to paint, dance, sing, play and film to infinity, this backdrop that constitutes the residual memory of the inhuman deflagration that made us what we are. Condemned to dance the unspeakable.

So let us be careful not to adopt this determinist and racist conception of human beings, to the point of making those among us who are capable of artistic expression – the storytellers and painters – the prisoners of our history.

For a non-deterministic history

Because the history of slavery is not our Big Bang – that first moment from which everything flows mechanically and irreversibly – because there is a past, that is the pre-colonial history of Africa and the Americas. And something beyond: the future to be built. Science and new conceptions of history have allowed us to discard this dangerous mechanical determinism and its conception of influence.

© Photo by Christopher Duggan



Scene from Revelations, the signature work of African-American dancer and choreographer Alvin Ailey (1931-1989).

In the middle of the last century, Werner Heisenberg introduced the notion of indeterminacy, or the uncertainty principle, into quantum physics. It means that an object is never anything but an object for a subject, and the subject who observes, separated ontologically from the observed object, cannot grasp it without knowing that he exerts an influence on it and he must take this influence into account. There is therefore no absolute and determined object, nor absolute subject, but a relationship. A relationship induced by the action, the movement, the thought of the subject himself in his relation to the object.

But what would be the nature of this relationship, of this influence, if the subject himself were determined, under the influence of a cause preceding him? It would simply be non-existent and understandable only in a mathematical equation. The principle of indeterminacy – which supposes a new, non-deterministic mode between us and our universe – therefore implies that the subject himself is indeterminate, that his action and thought are not subject to mechanical causality. In other words, the subject is free, in motion, in progress. And therefore he releases the object from himself. The object, through this dialectical indeterminacy of the relationship, regains its autonomy.

Beyond memory, being the subject of one's own history

This freedom is, in fact, that of our action within our own history. A history of which we are no longer the thinking objects, but the acting subjects. Although we are acting ourselves, by our own actions. No longer objects of a history that compels us to think through it, but subjects of a history that is built with us and by us.

We must therefore think of history, our history, no longer through the framework of the determinists, but with Hegel and his conception of the subject of history. Hegel, whose famous dialectic of the master and the slave is simply an illustration of the consequences of taking possession of one's own history by the subject who emancipates himself from it.

Our history and our memory influence us only to the extent that we ourselves influence it. From then on, this cosmic backdrop that is our memory is no longer our only horizon. We escape from this black hole to discover its relativity. We escape it to become ourselves, to create a new time that is none other than ours. This time of my being, of my action, which is none other than myself. I am time in action. I am its expression.



This trap, this cosmic net that could become my memory, closes in on the person I no longer am. It closes on a past history, put into perspective. A history that is now mine, that belongs to me, but of which I am no longer a prisoner. I become master of my history, because I have opened its horizon. Torn its net.

I am no longer condemned to dance the unspeakable, because as master of my time, master of myself, I am also master of my choices and my expression. I am a free and autonomous subject, emancipated from my memory, and my expression cannot be read and acted only through the prism of my past, whether individual or collective. I have opened the field of possibilities.

In other words, there is no moral or intellectual obligation for a black artist to paint the blackness of his history, since he is a free and autonomous subject and recognized as such.

The artist, whoever he may be, can no longer be considered the instrument of expression of a sponsor who would be his master – master of a subject to be depicted and expressed, master of a history and a cosmogony, master of an ethic and an aesthetic, master of a vision and a conception of the world bequeathed by a history of which we are prisoners – but as the acting subject, autonomous and free in his own expression, his own vision of the world, his own history.

It is then necessary for us to reconsider his work differently, through other aesthetic, ethical and political prisms. Given this freedom acquired over the determinisms of history, we must grasp the work of every artist, not as a forced expression of himself and his memory, but as the expression of a deliberate act, to which he gives meaning and existence.

The dialectic of the artist and his work

We can then perceive the artist in the dialectical order of a subject vis-à-vis his work, in the subject/object dialectic. This work is a differentiated expression, it expresses a *differance* – and we write this word with an *a* as Derrida does, because it is the act of differing, of coming out of oneself, of one's own time; something that is not oneself, or not entirely oneself. An expressive distance from oneself. The act of artistic creation is therefore critical because it expresses a crisis. *Krisis* in Greek means “separation, distinction”. But crisis also means, originally in French, “a decision, a choice”. This crisis is the dialectical moment of giving birth to something that comes from oneself, but is not self. This *differance* is an offering of oneself to what is not self, to the other. It produces an object, but a subjective object. What is meaningful in the work is that gift, which opens the possibility of sharing between the other and oneself – it is in this sharing that expression is found. In this relationship between subjects through a subjective object, which by nature engages a silent dialogue between the two.

Thus, because it is freely chosen by the autonomous subject who presents it to be seen, makes it a gift and an object of sharing with the other-spectator, the work itself acquires its autonomy, its own meaning, even its enigmatic quality, its indeterminacy, and can become an object of comprehension and understanding, differentiated from its author. This is why some authors can say that once the work is created, it no longer belongs to them – it is offered in its entirety to the universal of aesthetic input.

The artist, both free and influenced

It is precisely this established freedom that gives value to the gift, to the artist's offering of his work. It gives him the capacity to create, literally – that is, to produce something new from the old, to generate mutations of form. It is by reformulating material, namely a history sedimented in cultural, aesthetic or even ethical memory, that he produces meaning.

If an artist does so, it is because he is able, by choice, to bring his own liberated, autonomous energy to the residual memory that constitutes culture. His energy is his formal action, his power to work, in the sense that Aristotle defines the word *energeia* (literally “that which is fully at work”, but also “that which gives form, that does the work”) – form and energy being the same thing in reality, as physics attests.

We can thus say, starting from this *energeia*, that the artist is an oddball, a being possessed, one who is “worked” on. One could also say, starting from the verb *energeio*, that he is influenced. But then, how can the artist be simultaneously free, autonomous, emancipated and influenced? This is an apparent contradiction, resolved by the simple fact that the artist is an artist, free to choose his influence, free to let himself be possessed and be worked on by a dimension of the collective memory that he makes his own. And it is at this price, because he is free, that he can impose his own form and possess what possesses him, overlap what overlaps him. This choice is precisely what, in the Sartrean sense, can be called a commitment. He engages himself entirely in his chosen material; he takes the risk because this material possesses him. And if he is possessed by it, it is because he perceives in himself a necessity, a lack that he needs to fill.

This is how we must consider the residual memory of the history of slavery: as material for the artist who wants to grapple with it.

What the artist will produce from his work is what Aristotle calls *entelechy* (from *entelecheia*, the realization or complete expression of some function). A finality of form, in a way, produced by the energy-form of the artist who gives the work its autonomy.

But the work, which is not him, but which has emerged from him, remains a question, a form questioning the very enigma of history, questioning also this present in which this memory subsists.

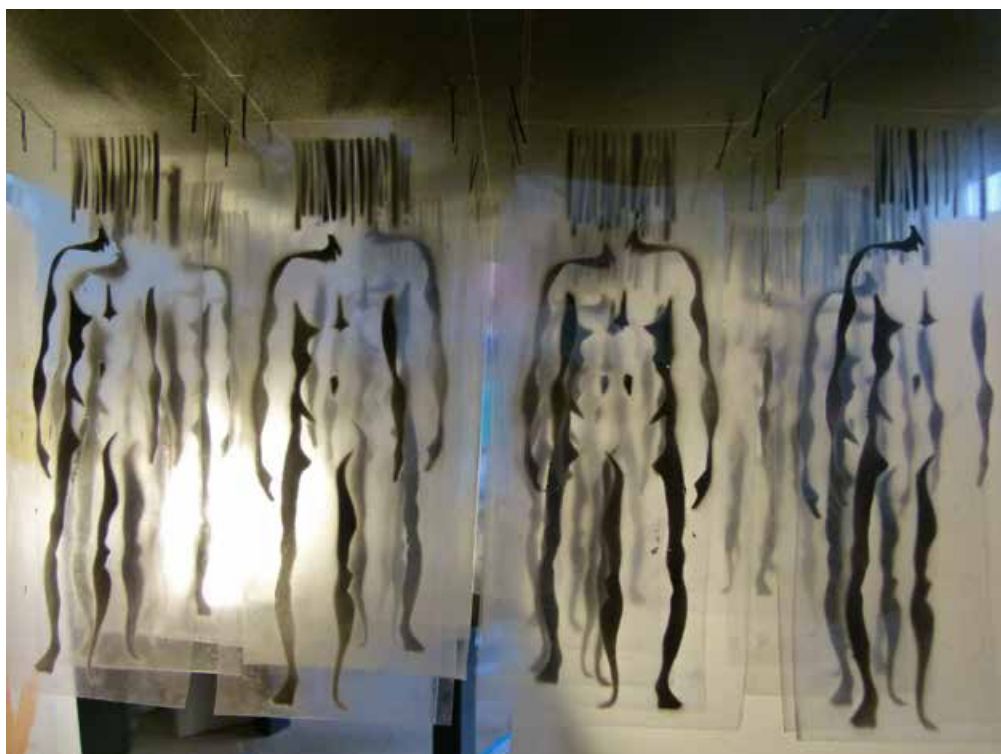
So isn't this work, which "journeys to its end" the act of this oddball who seeks to put an end to this memory inside him, to end this history with a new form that illuminates the past while leaving it in its place, by literally going beyond it?

A ruse of artistic intelligence

Thus the artist chooses his influence by exercising his artistic freedom precisely in order not to remain under the influence of the past and to produce the present instead. When we speak, for example, of the influence of African art or *art nègre*, on modern art – on Picasso, Braque, Derain, Matisse, even Apollinaire and the Surrealists – it means understanding it, not as the mechanical influence of an object on a subject, but as a relational dialogue. This influence arises because the artists were in a critical phase, questioning the forms inherited from their past and in search of new expressive materials. Thus Picasso's painting, *Les Femmes d'Alger*, is the fruit of a dialogue between a question of the West about its own aesthetics at a given moment, and African art, that we then discover is not "primitive" as described by some, but a bearer of creation and thought. This inspires Maillol to say that "*Art nègre* contains more ideas than Greek art". This encounter therefore produces both new forms of expression and a fresh perspective on the object that introduces a new aesthetic dialogue: in this case, African art.

What is called influence is in fact a choice dictated by a need for expression. And in this expression, there is an overlap between the subject and the object, there is possession. We can say in this sense that *Les Femmes d'Alger* is possessed by African art. The work is the product of the search for a new perspective, a transformation of taste, or as Nietzsche would say about music, "a renaissance in the art of listening". He was captivated by Bizet's *Carmen*, a work in which he found an African dimension. He was fascinated by it because an encounter takes place between the opera and the philosopher who, having separated himself from Romanticism and Wagner, sought a meaningful new aesthetic form that opened new horizons.

© Chichi Reyes



Héxadécimal, mixed media, 2015, by Chichi Reyes, Dominican Republic.

To speak of influence is in fact to speak of a search for new forms, new formal contents, capable of transforming our way of seeing, hearing and appreciating. This is a fight. Artistic creation is more than resistance – it is a "combat sport" against modes of perceiving the world and its objects that are sedimented and imposed by a dominant culture. When Martin Luther King said that "music is our weapon of war" he meant just that. This weapon is effective not only because it gathers forces around it, but also because it is able to enter the sensibility of the adversary and possess it. It speaks to him (the adversary) and, through sensibility, opens horizons. This is possible because gospel and blues in the United States are part of a common foundation, which allows blacks to speak to whites through a form of sound that opens the mind to the content of their speech. Even the speeches of the civil rights leader were chanted in the manner of gospel songs – which gave them greater penetration, and carried them towards a universal. He spoke in his speeches, of course, of the common memory of slavery, but in a form that created distance from it, to speak to his contemporaries.

In dance, Katherine Dunham and after her, Lester Horton and Alvin Ailey, drew elements from African or Indian traditions and from the memory of slavery, and incorporated these in their creation. It was part of a search for new forms that could both illuminate the past and produce a new perspective. Jazz was born in Congo Square, a place for slaves to meet and dance in New Orleans in the US, to integrate the constituent elements of their memory into a new musical form. But it was a memory distanced by the form itself, and creating an area for a sensitive exchange between several forms of culture, several horizons.

We can then speak of a *ruse of the artistic intelligence* that integrates the old into the new, by going beyond the past, and enabling it to influence the way it is perceived. This is undoubtedly the meaning of *métissage*, hybridization – a movement towards the new that creates a new influence. The goddess Metis, the first wife of Zeus, whose name literally means "advice, ruse", of whom Hesiod said "she knows more than any god or mortal man", was able to influence Zeus and make him change his mind.

Thus the integration of memory, whether of slavery or any other memory, into a new body and a new form, is a ruse of artistic intelligence to influence the present.



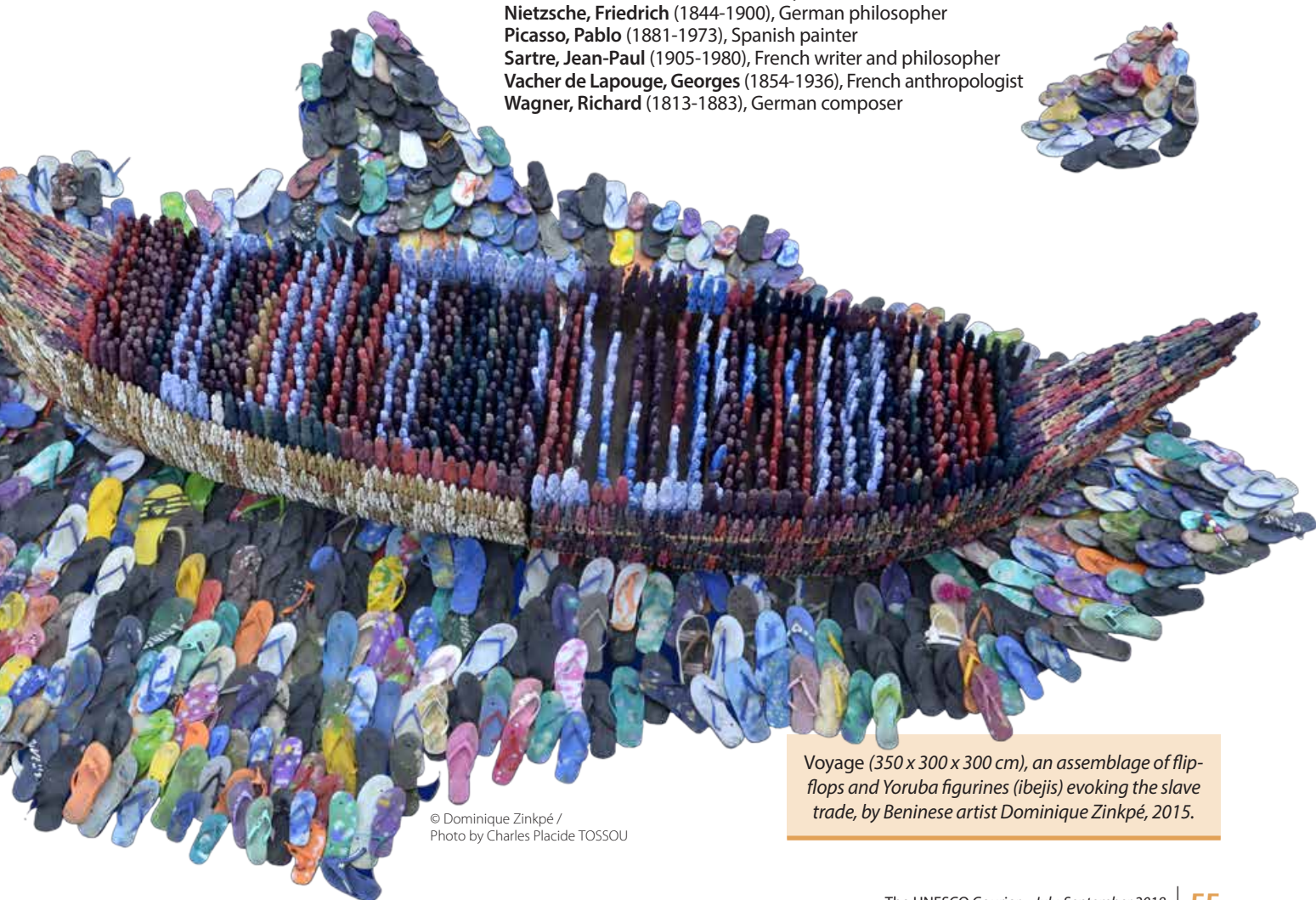
Today's art scene is teeming with examples of this in dance, music, theatre, art and cinema. This ruse is possible only as long as we accept that the artist has freed himself from his past by integrating it into his work – that, as a free and autonomous subject, he chooses this influence and is not its object. This also forces us to see the artist and his work as ontologically separate, although related in a certain way, chosen by the artist and his mode of action on the material of memory. It also means that we must look at the work as a work in its autonomy and in the enigma of its indeterminacy. It remains open, an object of sharing and therefore of differentiated judgements, of criticism.

Finally, starting from the work itself, we cannot induce the colour of its author. Do not confine the painter in his colour because it is not the colour of the painter that gives colour to his work – it is the work itself and the critical analyses it later inspires. This work that says, in the variety of its possibilities and in the infinite possibilities of its open form and its interpretation, what Lamartine said, fighting against the abomination of slavery: "I am the colour of those who are persecuted."

A writer, playwright, director and philosopher from Guadeloupe, **Alain Foix** is the founder of Quai des Arts, a multidisciplinary company that combines live performance with new technologies of image and sound. He is the author of several books, including *Je danse donc je suis* (I dance therefore I am, 2007); *Histoires de l'esclavage racontées à Marianne* (Stories of slavery told to Marianne, 2007); *Noir: de Toussaint Louverture à Barack Obama* (Black: from Toussaint Louverture to Barack Obama, 2009); *Martin Luther King* (2012) and *Che Guevara* (2015). His theatrical works include *Vénus et Adam* (2004), *Pas de prison pour le vent* (No prison for the wind, 2006) and *La dernière scène* (The last scene, 2012), a private conversation between Martin Luther King, his wife Coretta and American activist Mumia Abu-Jamal.

Names mentioned

Ailey, Alvin (1931-1989), American dancer
Apollinaire, Guillaume (1880-1918), French poet
Aristotle (4th century BC), Greek philosopher
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Blumenbach, Johann Friedrich (1752-1840), German anthropologist
Braque, Georges (1882-1963), French painter
Chamberlain, Houston Stewart (1855-1927), British essayist
Cuvier, George (1769-1832), French anatomist
Derain, André (1880-1954), French painter
Derrida, Jacques (1930-2004), French philosopher
Dunham, Katherine (1909-2006), American dancer
Einstein, Albert (1879-1955), physicist of German origin
Gobineau, Arthur de (1816-1882), French writer
Hegel, Georg Wilhelm Friedrich (1770-1831), German philosopher
Heisenberg, Werner (1901-1976), German physicist
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Horton, Lester (1906-1953), American dancer
King Jr, Martin Luther (1929-1968), American civil rights activist
Lamartine, Alphonse de (1790-1869), French poet
Laplace, Pierre-Simon de (1749-1827), French mathematician
Maillol, Aristide (1861-1944), French sculptor
Matisse, Henri (1869-1954), French painter
Nietzsche, Friedrich (1844-1900), German philosopher
Picasso, Pablo (1881-1973), Spanish painter
Sartre, Jean-Paul (1905-1980), French writer and philosopher
Vacher de Lapouge, Georges (1854-1936), French anthropologist
Wagner, Richard (1813-1883), German composer



Voyage (350 x 300 x 300 cm), an assemblage of flip-flops and Yoruba figurines (ibejis) evoking the slave trade, by Beninese artist Dominique Zinkpé, 2015.

© Dominique Zinkpé /
 Photo by Charles Placide TOSSOU



Our quest



La Bataille d'Alger

UN FILM DANS L'HISTOIRE

Un film de Malek Bensmaïl

Un film écrit et réalisé par Malek Bensmaïl - Montage Mathieu Dretaud - Photographie Redjane Berder - Musique originale Karim Ziad - Mixage Delphine Thellier
Direction de production Anne Louis, Pauline Cornillet - Producteur Gerald Collas
Une coproduction INA - Histoire - Imago Film (Suisse) - Hikayet Films (Algérie)
Avec la participation de Cine+ - RSI Radiotelevisione svizzera - Al Jazeera - Hideo Canada
Avec le support du Centre National du Cinéma et de l'Image Animée, La MOCIF - Société des Producteurs, L'ANGOA,
Boulevard Wain révisé de la Scam et du dispositif La Culture avec la Copie Privée.



Poster from The Battle of Algiers, a Film within History, a documentary by Malik Bensmaïl.

© Hikayet Films/Ina



“Filming reality can be disturbing, but it matures you”

Malek Bensmail

Malek Bensmail, interviewed by Jasmina Šopova



Portrait of Malek Bensmail, 2016.

© Bruno Lévy / Divergence

Three years after Algeria's independence in 1962 – and after eight years of civil war – Italian director Gillo Pontecorvo shot *The Battle of Algiers*. The film is about one of the bloodiest episodes in the Algerian war, when Algeria's pro-Independence National Liberation Front (FLN) clashed with the French colonial authorities in 1957.

On 19 June 1965, even as the film was being shot, Colonel Houari Boumédiène's FLN troops entered Algiers. Tanks being used for the film got mixed up with the real tanks, and President Ahmed Ben Bella's supporters could see nothing but fire. As a result, he was overthrown! Half a century later, in 2017, Malek Bensmail examined the historic role of Pontecorvo's black-and-white newsreel-style classic in his documentary, *The Battle of Algiers, a Film Within History*. But this is not a “film about a film”, he explains. It is more an interpretation of his country's history – the revolution, the coup, the regime changes, the decolonization. For almost thirty years, the Algerian director has been creating what he calls “the contemporary memory” of his country.

Why did you choose documentary film as a medium of expression?

More than fiction, documentary film is capable of countering national myths. Not to destroy them, but to put them in their place, so that they do not crush society. If you do not film your own reality, how will you be able to watch yourself? Where would your inspiration come from? Where would your dreams come from? Also, do we need to be reminded, cinema was born from the documentary – remember the Lumière brothers? The documentary film determines the collective imagination. It is this reality that nurtures fiction and holds up a mirror to society. I know that filming real life can be disturbing; but I also know that it matures you.

In the 1990s, when we were in the middle of the “black decade” in Algeria, I opted for reality. And I continue along that path. My idea is to make a film every one or two years, about people, institutions, important social issues. I would like these films to provide a better understanding of how a country is built over time.

My intention is to create a *contemporary memory*, by showing this laboratory, which is Algeria – a country searching for its identity, with its progress, its setbacks, its questions. You don't achieve democracy with a snap of the fingers. Or with guns, for that matter!

One of the assets of democracy, press freedom, is the subject of your film about the independent Algerian newspaper, *El Watan*, released in 2015. Why did you call it *Checks and Balances*?

A free press is a democratic asset that many journalists paid for with their lives, during the civil war in Algeria. The war, which broke out in 1991, left 200,000 dead and 100,000 missing. Around 120 Algerian journalists were murdered by Islamist extremists between 1993 and 1998. But that still does not mean that the free press represents a real force of opposition in my country today.

For this film, I decided to take an “oblique” look, by following a team of journalists at work. What interested me was not so much the press as a counter-force, but the counter-forces represented by individuals.



In Algeria, the notion of the individual has not yet fully developed. We are locked into the idea of a community. We have a nation to defend, a country to defend, a god to defend, a language to defend. There is always that “one” figure, which is omnipresent, omnipotent, which is supposed to include us all – while in reality there are celebrities, intellectuals, journalists, judges, students, etc., who live in a multicultural and multilingual space, who think differently and who constitute a set of small checks and balances necessary for a democracy.

What good is an independent newspaper if it has no impact on society?

Even when it does not constitute a real counter-force, the free press does manage to condemn the invisible acts of violence no one talks about. Algeria is currently seen as a calm country, protected from terrorism, but in fact it is not immune from humiliation and manipulation.

El Watan is not the only newspaper doing this work. There are a few others, including *Le Quotidien d'Oran*, *El Khabar*, *Liberté* and, to a certain extent, *Le Soir d'Algérie*, which are also involved in the resistance and the struggle. They are not opposition newspapers.

Their objective is to provide accurate information from balanced sources. Besides, most of them have websites that are free and accessible to everyone, including the diaspora.

What is El Watan doing to preserve its independence? How does it ensure its survival?

Through newspaper sales – it has a print run of 140,000 copies, which sell at 20 Algerian dinars (about €0.20) each – and through advertising. The paper, which has been deprived of advertising revenue from the state since 1993, has invested in an advertising and distribution network, and in an independent printing facility which it shares with *El Khabar*. The paper has also turned to the private sector for advertising, which enables it to pay the 100 journalists and correspondents that make up its editorial staff.

That said, the newspaper has had at least six interruptions in its publication, and has been involved in some 200 lawsuits, which have made it financially vulnerable.

Scene from the documentary *La Chine est encore loin*, by Malek Bensmail, 2008



I was surprised to hear Omar Belhouchet, the paper’s founder and director, say that he found these court cases very important for the democratic process. I thought they were painful experiences, but he felt that they allowed him not only to defend journalists and cartoonists, but also to defend the very notion of the freedom of expression, which is written in the Constitution.

These trials give him (Belhouchet) the opportunity to explain to the court what a caricature is, what humour is, what a chronicle is, what an investigation is, and where the restraints in society are. He actually uses these court cases to educate young magistrates about freedom of the press.

Education is central to your 2008 documentary, *La Chine est encore loin (China is Still Far Away)*. Why do you refer to China when it’s about a classroom in a school in Tiffelfel, a small village in the Aurès mountains, where the Algerian war began, in November 1954?

The title refers to a quote from the Prophet Muhammad: “Seek knowledge, going all the way to China, if need be”. China is therefore a symbolic land, the land of knowledge, which can only be reached with considerable effort. A land that is still far away, seen from Algeria.

Just before making this film, I had shot a documentary on madness (*Aliénations*, 2004). I spent three months in a psychiatric hospital and came across many cases of people with politico-religious delusions. I wondered what the origins of this pathology were. A psychiatrist gave me the answer: “It’s society”. That encouraged me to go and see how young people were being taught, what ideas were being passed on to them at school. So, I went to the school in the village where the Algerian war had started.

It was a very violent war, that lasted almost eight years. Thanks to its victory, Algeria has become a myth, and successive regimes have worked hard to consolidate this myth. I’m not saying it is not a good thing to forge a sense of national pride among the people, and for them to value their heroism. But I disagree when this is done in a way that is completely out of step with local daily life. I wanted to film an Algeria that works every day, that fights every day, under that myth.

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© Unlimited/CirraFilms

The film shows the gulf that separates the myth from the social reality. At the end of the day, we realize that what we are teaching children is hatred of the other. The film also shows that Koranic education today is far removed from the words of the Prophet. Political Islamism has done a lot of damage that is still being felt today, especially in rural areas.

Is that the reason why only one woman – Rachida, the school cleaner – is given a voice in the film?

Rachida is amazing. She gave me a wonderful lesson in freedom! She comes from another village in southern Algeria, from where she had to escape because she was divorced and was therefore considered a prostitute.

It was impossible to interview other women, even though, in this region, women were once known for their management of the economy – carpet-making and farming were in their hands. Today they are hidden behind the walls of their houses. In the countryside, they hardly ever leave their homes, even veiled.

It is the men who go to market. That is unheard of! The years of Islamism and conservatism have wiped out the traditional social role of women, along with all the gains they had achieved with their emancipation. During the shoot, they sent us trays of food, cakes and coffee through the children, but we didn't see a single woman.

“You make a film with, not about, people in real life,” says director Malek Bensmail. This group of students helped with the shooting of La Chine est encore loin.

Algerian film director **Malek Bensmail** has been making documentary films since 1990, while his country was going through the “bloody decade”. His films have received critical acclaim and several prizes at international festivals. They have been screened in cinemas and broadcast on television worldwide, on channels including Arte (France-Germany), TV Cultura (Brazil), RTBF (Belgium), TV3 (Spain), YLE (Finland), France TV, Canal + (France), RTSI, RTSR (Switzerland), Channel Four (United Kingdom), and global television networks TV5 Monde and the BBC. In 2010, he was the Villa Kujoyama laureate in Kyoto, Japan. A retrospective of his work exhibits at leading universities in the United States in autumn, 2018.



Current affairs



Photo from the Genesis series by Brazilian photographer Sebastião Salgado, taken in the Galapagos, Ecuador, in 2005.

© Sebastião Salgado



Galápagos: where inhabitants take charge



© Sarah Del Ben

At the fish market in Santa Cruz in the Galápagos, March 2018.

What do we imagine when we think of the Galápagos? Giant turtles, marine iguanas, finches, Darwin and his theory of evolution? Yes, of course. But the Galápagos are much more than all that – they are also a community of 28,000 inhabitants spread around four islands: Santa Cruz, San Cristóbal, Isabela and Floreana. And it is thanks to its people, who are invested in the participatory and sustainable management of the resources of the archipelago that some 240,000 tourists are able to visit this paradise each year. Ecuador's Archipiélago de Colón has been a World Heritage site since 1978 and a Biosphere Reserve listed since 1984 in the global network managed by UNESCO.

Located a thousand kilometres from the mainland, the archipelago, home to one of the richest marine ecosystems in the world, includes thirteen large islands – and 147 small islands and rocks – that were formed four million years ago. Most of these are in fact submarine volcanoes, some of which rise more than 3,000 metres from the bottom of the Pacific Ocean.

Covering an area of 7,500 square kilometres, the Archipiélago de Colón – Galápagos Biosphere Reserve covers the entire land surface of the Galápagos National Park.

The Galápagos are one of the best models of harmonious and mutually beneficial interaction between humans and their natural environment. The management strategy of the biosphere reserve focuses on food production that benefits the local economy, respects ecosystems and avoids the introduction of invasive species that would endanger endemic biodiversity.

At the heart of the reserve, the Galápagos National Park is a successful example of participatory management, allowing local people to live sustainably from the resources offered by activities such as fishing, livestock, tourism or recreation, through judicious management plans that include local food production and waste recycling.

To take the example of coffee, a cooperative was created in 2015 – bringing together farmers, roasters and traders – to improve the production and marketing of the eight varieties of arabica, cultivated for a century on the islands, at 250 metres above sea level. Renowned for its flavour, Galápagos coffee is sold at a price that is seven times higher than mainland coffee. The pesticide-free production, harvesting and processing comply with environmental protection rules – which will soon lead to the certification of these varieties as designations of origin.

The municipal government of Santa Cruz island has been developing and coordinating initiatives for the recycling of solid waste for the last ten years. These include launching education and awareness programmes on environmental problems, banning the use of polyethylene materials and prohibiting the import of beers and soft drinks in non-recyclable packaging.

But all these initiatives owe their success primarily to the villagers, who take ownership of the environmental protection and safeguarding projects. Craftsmen use recyclable materials to make objects; masons use recycled blocks or glass tiles in the construction of houses; the fishermen are mobilizing for the ban of plastic nets and collect the waste that pollutes the sea themselves, while all the inhabitants regularly engage in cleaning up the beaches.

Since 2017, half of the solid waste from the islands has been recycled through a waste selection and recovery programme in which the local population is actively involved.

Through the Biosphere Reserves as a Tool for Coastal and Island Management in the South-East Pacific Region (BRESEP) project, UNESCO's Man and the Biosphere Programme (MAB) is currently working – in collaboration with the Government of Ecuador, the Galápagos National Park and local communities – to extend the biosphere reserve to 133,000 square kilometres, so that it includes the Galápagos Marine Reserve, a genuine sanctuary for marine life. At the confluence of several ocean currents, where cold and warm waters mix, it is home to a multitude of endemic species, but also to species from different areas of the Pacific Ocean.

Financed by the Flemish government of Belgium, the BRESEP project supports the creation of biosphere reserves as tools for innovative and socially, culturally and environmentally appropriate practices. It also encourages the establishment of a collaborative network for the exchange of information and experiences on biodiversity loss, coastal zone management and sustainable development. The project particularly involves the coasts and islands of the South-East Pacific, located in Chile, Colombia, Ecuador, Panama and Peru. These efforts are contributing to improved livelihoods for the people of the region.

Waste recycling in Santa Cruz in the Galápagos.



© Sarah Del Ben

Luc Jacquet

In March 2018, French film director Luc Jacquet, who won an Oscar for his documentary *March of the Penguins* (2005), travelled to the Galápagos with French photographer and film director Sarah Del Ben on a scouting trip for a future film project. They were accompanied by experts from UNESCO's Man and the Biosphere Programme (MAB). This is their experience.

This article marks the 30th session of the MAB Council in Palembang, South Sumatra, Indonesia, 23-28 July 2018.

This morning, as I walked through the alleys of Santa Cruz, I saw an old man reading his newspaper. A sea lion casually kept him company, sitting on the same bench. A little further away, men just back from fishing were selling fresh fish that would be eaten the same day. I continued on my way, meeting passers-by, tourists and iguanas. Walking only a short distance away from the alleys, I could see children playing around century-old giant turtles, which were grazing peacefully in the grass.

I've travelled the world, but I've never before witnessed such proximity between different species, except perhaps in Antarctica. These places, so far from everything, are ultimately the last sanctuaries of harmonious life between humans and nature. And yet, in both cases, living conditions are extreme.



Man and nature reconciled



© Sarah Del Ben

French director Luc Jaquet, on a reconnaissance trip to the Galápagos, with a team from UNESCO in March 2018.

In the arid lands of the Galápagos, burned by the sun and so hostile to life, human activity and biodiversity are not in conflict. One has the impression of being in a life-size laboratory and witnessing the brilliant demonstration that it is possible for humans and animals to live together – as long as we put in place sound resource management policies that allow ecosystems to survive. The archipelago should serve as a model for the rest of the world, on how to bridge the gap we have created between ourselves and other living beings.

Participating in the conservation of ecosystems is always a complicated task. But above all, we must learn to know and love them. If each of us does this, using our talents and know-how, I am convinced our collective efforts will bear fruit. I deeply believe that this collective energy will enable us to move towards a way of life in which we will no longer be colonizers, but managers – and towards a society that appreciates the value of the planet on which it lives.

For my part, I am fortunate to have the know-how that allows me to play the modest role of mediator between science and the general public. I can make images that convey messages with an effectiveness that is now proven. And I put this know-how at the service of the planet. That is why I want to support the UNESCO-MAB Programme – its aspirations are in line with mine. Its philosophy is based on an idea that I fully endorse, that of living together.

Cinema is a wonderful tool for awakening awareness. It uses the language of emotion and metaphor. Far from indulging in a moralizing or guilt-laden discourse – which has been proved to be relatively ineffective – a film acts on both the hearts and minds of its audience. It thus incites them to appropriate things of nature – because of their beauty, because of their interest, or simply out of curiosity.

Climate change and the loss of biodiversity are complex issues. Cinema is able to make them accessible to the public by translating them into stories that are both simple and universal in scope. This is how it opens this first door that leads us onto the path of awareness.

And when we are on this path, we understand what an illusion it is to imagine for a moment – and yet the last four or five generations of human beings have done it – that we can live, cut off from nature. We come from nature and we need nature for things as basic as breathing, drinking or eating. But we also need nature so that we can dream.

The secrets of Tiwanaku,

revealed by a drone



Lucía Iglesias Kuntz (UNESCO)

Tiwanaku, the spiritual and political centre of Bolivia's Tiwanaku culture, is seventy kilometres west of La Paz and fifteen kilometres from the shores of Lake Titicaca. Inscribed on UNESCO's World Heritage List since 2000, the place still holds many secrets today. A UNESCO project reveals some extraordinary discoveries.

The publication of this article coincides with the 42nd session of the World Heritage Committee, held from 24 June to 4 July 2018, in Manama, Bahrain.

A map of Tiwanaku, created using data from the 3D model generated by a drone. The black lines probably indicate domestic structures in the Mollo Kontu area.

© José Ignacio Gallego / UNESCO

With its monumental complex of buildings and its location at more than 3,800 metres above sea level, Tiwanaku is one of South America's most spectacular archaeological sites. A pre-Columbian city in the southern Andes, it was for centuries the capital of a vast and powerful empire that owed its supremacy to the use of innovative materials and techniques to improve agricultural production, thus increasing its economic power. It was from Tiwanaku that the eponymous culture spread, reaching its peak between 500 AD and 900 AD. From there, its influence radiated over a vast territory that included western Bolivia, southwestern Peru and northern Argentina and Chile.

Unfortunately, Tiwanaku was brutally plundered, following the collapse of its culture in the thirteenth century. The place attracted hunters of buried treasure like a magnet, and much of its valuable heritage disappeared. Numerous historical documents also show that the site became a quarry, from which to extract materials to build modern buildings – the evidence of which is still visible in the town centre nearby, and even in La Paz, the Bolivian capital.

President Evo Morales, who is of indigenous Aymara descent, chose Tiwanaku as a symbolic location for the inauguration of each of his three terms as head of the Bolivian state (in 2006, 2010 and 2015). As a result, the site has regained its prestige, and become an important tourist destination. It takes a lot of effort, however, for the visitor to appreciate and understand it fully. Tiwanaku is more an exercise in observation and documentation than in simple contemplation. This is because all that remains of the city's majestic ensemble of temples and palaces are the ruins or partially reconstructed remains of seven great buildings – the Akapana Pyramid, the temple of Kantatayita, the temple of Kalasasaya, the Putuni Palace, the Kheri Kala Palace, the Puma Punku Pyramid, and the small semi-subterranean temple.



© Ernestina Cortés Albor / UNESCO

*An Aymara ceremony
in Tiwanaku, Bolivia.*

These remnants, nevertheless, exhibit the unmistakable hallmark of great civilizations, with marvels such as the Puma Punku (Doorway of the Puma), made of solid blocks of sandstone, weighing up to 130 tons, assembled with copper staples. This was an astonishing feat for a civilization that lacked the concept of the wheel – some experts estimate that between 1,300 and 2,600 people would have been needed to lift the stones. The knowledge of the use of metal demonstrates the civilization's military superiority.

New discoveries

The need to provide the site with an updated management plan – a requirement for all sites inscribed on the World Heritage List – as well as an educational programme and museums to help solve some of Tiwanaku's riddles, constitutes the *raison d'être* of the Preservation and Conservation of Tiwanaku and the Akapana Pyramid project. Launched in 2015 by the UNESCO Office in Quito, the \$870,000 project is funded by Japanese Funds-in-Trust for World Heritage.

This ambitious undertaking, which has just been completed, also included a plan for sustainable tourism – since Tiwanaku is located on the Altiplano, a seismic zone in a valley set between two mountain ranges – and finally, at the request of the World Heritage Committee, the completion of a topographic survey of the entire site.

"I was already working in the field, so I proposed to UNESCO that this topography study be done using remote sensing, because now, with drones and satellites, topographic results with very high precision can be obtained," explains archaeologist José Ignacio Gallego Revilla, who worked on the project on behalf of the Organization. "It took us a year to set it up. Since I was collaborating with the Complutense University of Madrid, I thought of going to its Campus of Excellence – which is actually a group of laboratories formed by various faculties, with excellent professionals and very competitive prices. But we needed a drone that could fly at more than 4,000 metres and, as we couldn't transport the one available at the university in Madrid to Bolivia, we approached a Swiss company that sells its aircraft in Chile and Bolivia. That company picked up the images which we then analysed in Madrid, in the laboratory."

“For me, it's the discovery of a lifetime: Tiwanaku has been one of the historical references of world archaeology for 500 years”



A coloured-in view of the Akapana pyramid. The red lines correspond to canals already known from archaeological digs. The black lines indicate possible canals, the deterioration of which may have caused large cracks in the building.

© José Ignacio Gallego / UNESCO

The imaging was done between October and December 2016 and the first results were obtained in May 2017. The drone provided a highly accurate topography of the entire archaeological site, with a margin of error of less than four centimetres.

The resulting map revealed the presence of a set of hitherto unknown structures that extend over the entire explored area of more than 411 hectares. In total, the heritage area covers over 600 hectares – six times larger than previously estimated.

After the analysis, the images taken by the drone made it possible to identify the traces of a stone temple buried next to a hundred or more circular and rectangular structures of vast dimensions, which were possibly domestic units, as well as ditches, canals, roads and other constructions in different sectors. But the new data also redefined known monuments, such as Puma Punku, a temple complex of which only two hectares had been explored, and which we now know has two more platforms that are buried. “The drone has revealed that this a religious complex covering seventeen hectares, which is three times the size of the Great Pyramid of Giza in Egypt,” explains the archaeologist.

“Suddenly we had a map of the site and of everything that is still buried there,” Gallego Revilla added. “For me, it’s the discovery of a lifetime: Tiwanaku has been one of the historical references of world archaeology for 500 years. As a researcher, things like this happen only once in your entire career,” he enthuses, displaying the maps and images that support his claim, on his computer.

Involving communities

Julio Condori, director of the Archaeological, Anthropological and Administrative Research Centre of Tiwanaku (CIAAAT), the site’s managing body, has been involved in the project since its beginning. For him, the new topographic map is in itself a conservation tool. “We now have 650 hectares under study,” he notes. “This marks a milestone for further research and an expansion of the area under high-level protection.”

Another strong point of the project is that the indigenous communities that inhabit the site, on its northern and eastern sides, were consulted at all times. The municipality of Tiwanaku currently includes three towns with twenty-three communities, and some 12,000 people, who live in the archaeological zone itself, and its immediate surroundings. “At each stage of the project, we had a very dynamic interaction with the inhabitants. I would say that this is precisely the key that allowed us to reach this result,” adds Condori. “Members of the Huancollo and Achaca communities participated last year in the surveys we conducted to verify if the reality corresponded to data provided by the drone, and they did so with great pleasure. We have to continue communicating our results so that they can take ownership of them.” At the same time, the number of national and international visitors – more than 125,000 in 2017 – continues to increase. “With that income, the site is economically self-sufficient, and it gives us the means to work with architects, chemists, geologists, etc.,” says Condori. “We hope to continue working with the municipal and national authorities, and of course, with UNESCO’s support.”

According to an Aymara legend, the ancestors concealed the most emblematic monument of Tiwanaku in the Puerta del Sol, the Gate of the Sun. It was an important secret that would save humanity when it reached the brink of the abyss. Fortunately, that moment does not seem to have arrived yet. Instead, what is certain is that all the good work and the flight of a drone has opened up a new era for the culture, that from the shores of the sacred Lake Titicaca, established the most advanced society of its time and managed to create a new kind of state hitherto unknown in this corner of the American continent.

The UNESCO Courier is 70!

The only journal Nelson Mandela read on Robben Island

Annar Cassam

“Apartheid represents today the vilest form of modern slavery. UNESCO's patient but tenacious and vigorous action ties in with the struggle of the South African blacks themselves, who have shown that with the courage of revolt they have discarded fear and regained hope. If the international community is to remain true to itself, it must mobilize and act firmly in order not to disappoint that hope.” This is what Prisoner number 466/64 of Robben Island, Nelson Mandela, read in the *Courier*, under the very noses of the watchful agents of the police state that was apartheid South Africa.

With this article, the *Courier* marks the 100th birth anniversary of Nelson Mandela, who was born on 18 July 1918.



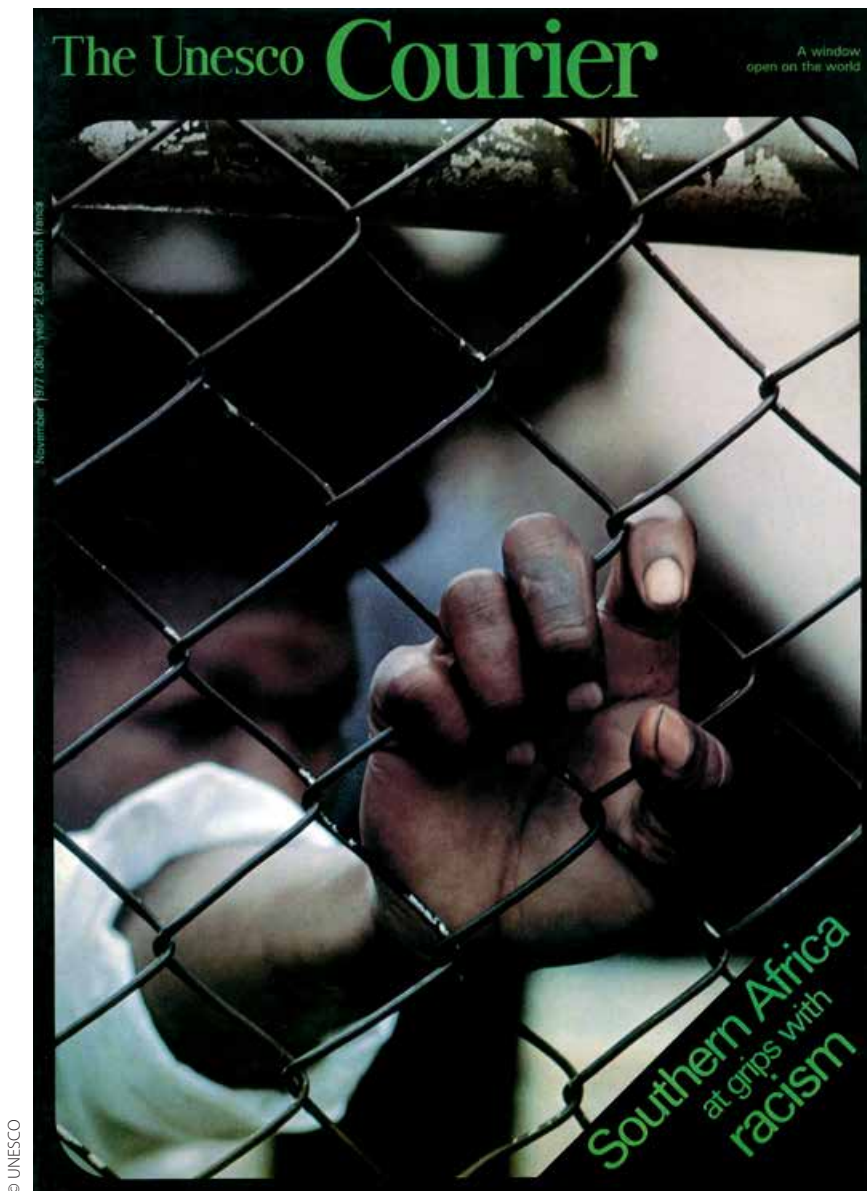
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Nelson Mandela, President of the African National Congress and Federico Mayor, Director-General of UNESCO (1987-1999), at the Organization's Headquarters on 14 October 1993.

Nelson Mandela and his fellow political prisoners were condemned to life imprisonment in 1964. Their first years in jail were as intellectually and spiritually barren as the terrain of Robben Island itself – the prison authorities made sure of that. Newspapers, even local ones, were not allowed. “The authorities attempted to impose a complete blackout, they did not want us to learn anything that might raise our morale or reassure us that people on the outside were still thinking about us,” Mandela writes in his autobiography, *Long Walk to Freedom* (1994).

But prisoners could apply to study for high school and university courses and thus order publications necessary for their studies. And so, together with books on subjects such as accounting and economics, the prison administration also allowed in the *UNESCO Courier* magazine, which, for some time, arrived regularly from Paris.

The prison authorities, who were mostly, if not exclusively, Afrikaans-speaking, clearly considered the magazine to be harmless reading material for this class of prisoners. After spending the day smashing stones in the limestone quarry, they could retire to their cells in the evening and read the *Courier's* “insignificant” contents.



© UNESCO

Cover of the UNESCO Courier,
November 1977.

It was President Mandela himself who recounted this in September 1996 to the then Director-General of UNESCO, Federico Mayor, in Union Buildings, the President's Office in Pretoria, during Mayor's official visit to the new democratic South Africa.

The President explained how pleased he and his companions had been to read the *Courier*, through which they had learnt about so many subjects they had never encountered before – such as cultural diversity and mankind's common heritage, African history, education for development, and so on. These subjects did not exist in the apartheid lexicon, let alone in the solitary confines of Robben Island.

Reading the *Courier* was a way of learning about what was happening in the real world outside. Nelson Mandela was keen that UNESCO's Director-General was informed of this.

I had the privilege of accompanying Federico Mayor on that visit. As I listened to the President's words, my mind tried to take in their meaning and significance. The *Courier*, so aptly named, was the carrier-pigeon that flew regularly from Paris to a remote spot in the middle of nowhere in the southern Atlantic Ocean – bringing news and ideas from the five continents to Mandela and his colleagues, under the very noses of the watchful agents of the police state that was apartheid South Africa. Knowledge and ideas grow wings when necessary.

Apartheid: no escape

Robben Island was the South African Alcatraz, an island penitentiary from which there was no escape for the black common-law convicts who were sent there for life. In the 1960s and '70s, as the struggle against apartheid strengthened and spread, the island became the place where the racist government sent its most serious political opponents – also for life. In reality, the island was a prison within-a-prison, for the principal jail was mainland South Africa itself. Here, the white minority settler community was locked inside its paranoia about its own racial superiority over the indigenous population. Every aspect of existence, both private and public, was governed by racist laws designed to oppress and denigrate the black majority for the benefit of the white minority population, which was privileged in every way.

In so doing, the ruling class claimed to be preserving and promoting "European values", in keeping with their self-styled "civilizing mission" in Africa. Ironically, they themselves were complete strangers to those values – for they had no understanding of concepts such as liberty, equality, democracy, fraternity, values for which the Europeans themselves had fought, across the centuries.

Indeed, UNESCO and the entire United Nations system were born out of just such a struggle – a decimating war against Nazi racism which had brought the world to the edge of the abyss in the Second World War. In 1945, the lesson was learnt that "never again" would the nations of the world allow such horrors to happen. At UNESCO, these countries decided deliberately to "build the defences of peace in the minds of men" (see UNESCO's Constitution), by sharing and expanding human knowledge in all its aspects, especially through the areas of education, science and culture.

The apartheid regime, however, learnt a different lesson and chose to go the opposite way – to promote separation, exclusion, deprivation, humiliation and violence. For those citizens who dared to question and challenge this backward ideology, the punishment was banishment for life.

“Newspapers are more valuable to political prisoners than gold or diamonds, more hungered for than food or tobacco”

Nelson Mandela

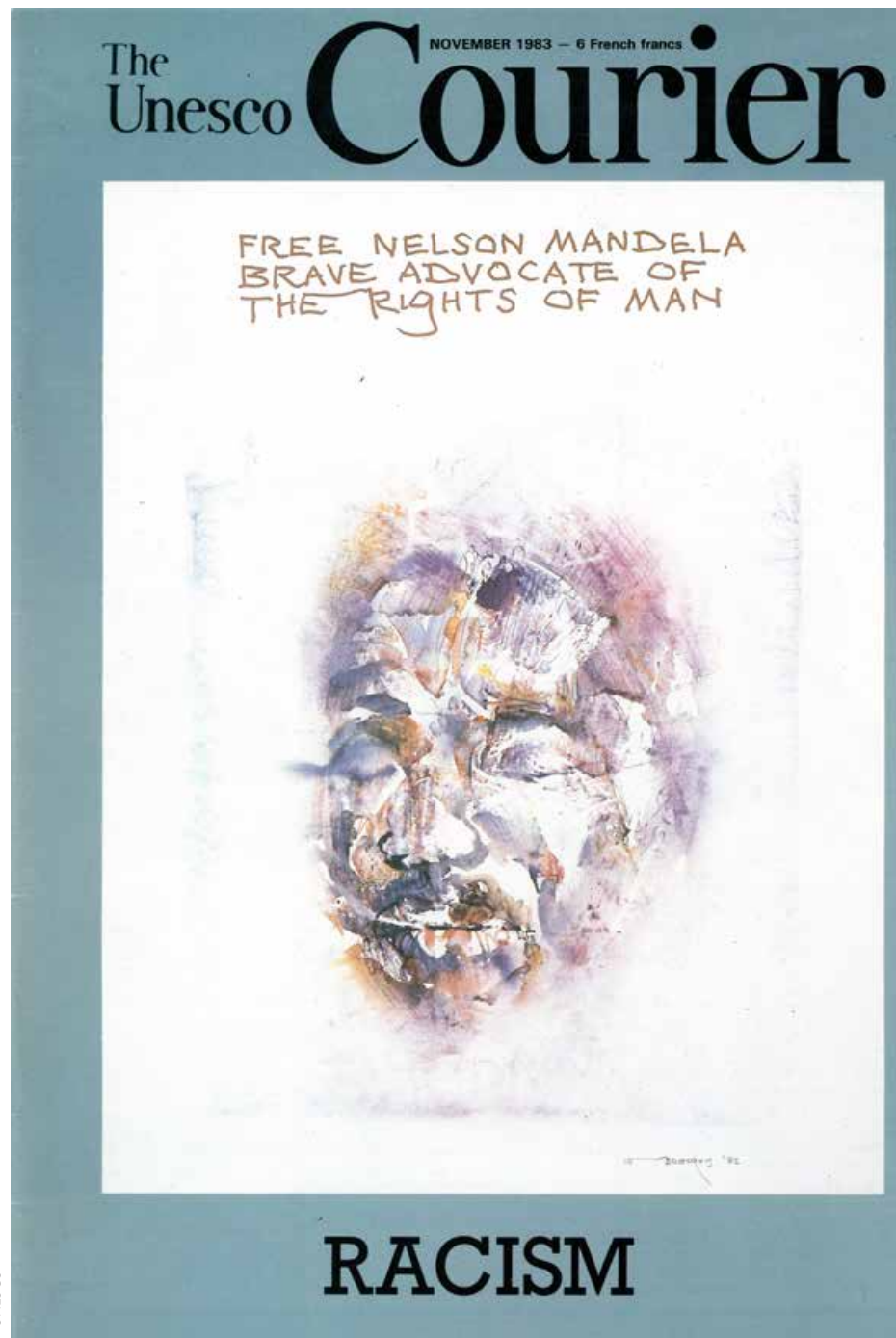
Reading about racism on Robben Island

I see Mandela and his fellow freedom fighters smiling with satisfaction when reading the article on racism written by John Rex, British sociologist and educationist, in 1968: “The most striking instance of racism in the world today is that of the system of Apartheid in South Africa. Apartheid is not as some people may still imagine a serious attempt to provide equal though separate facilities for all races. It is segregation carried through by men with white skins to their own advantage and to the disadvantage of the black and coloured populations.” (The ubiquitous shadow of racism).

Less than ten years later, the massacre of schoolchildren by heavily-armed police during the Soweto uprising in 1976 was a watershed in the history of the struggle. It brought to the streets an angry younger generation of fighters against apartheid, revolted by the imposition of Afrikaans as the language of instruction in black schools.

It also made it obvious to the outside world that the racist government had no strategy except the use of brute force, even against unarmed school children. By this time, South Africa had become an international pariah state, shunned by almost all the people of the world, if not by all governments.

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Cover of the UNESCO Courier, November 1983. The portrait of Mandela was painted by Irish artist Louis le Brocqy.

In November the following year, the *Courier* published a special edition on racism in South Africa, *Southern Africa at grips with racism*, which started with these words: “Apartheid represents today the vilest form of modern slavery.

UNESCO's patient but tenacious and vigorous action ties in with the struggle of the South African blacks themselves, who have shown that with the courage of revolt they have discarded fear and regained hope. If the international community is to remain true to itself, it must mobilize and act firmly in order not to disappoint that hope.”

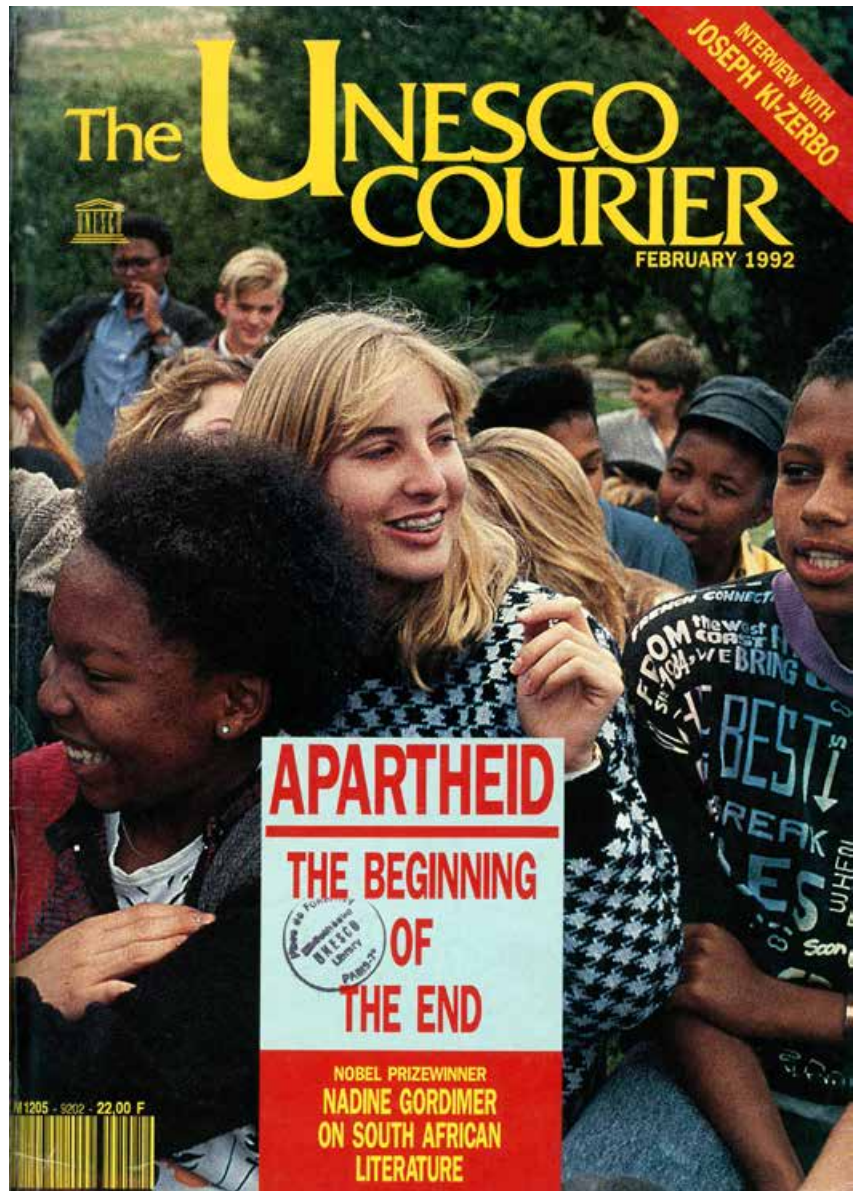
This issue was unlikely to have been allowed on Robben Island, but by then the struggle had reached the world stage and it was beginning to dawn on some of the leaders in Pretoria that they would be needing Mandela – sooner or later.

“On 11 February 1990, Mandela walked out of the prison gates, establishing himself as the country’s moral leader.”

As the years went by, Mandela and his cause grew in strength and stature, while the apartheid regime continued on its path of destruction and violence against its own black population and against neighbouring African states.

Mandela’s long period on the island came to an end in 1982, when he was brought back to the mainland to Pollsmoor Prison in Cape Town, and then finally to house arrest and to the relative "comfort" of a cottage in the Victor Verster prison outside the city. During this phase in captivity, which lasted until 1990, Mandela spent hours "talking to the enemy", as he puts it, by initiating dialogue and discussion with the more intelligent, less bigoted members of the regime, in order to make them understand that state violence and military action would not resolve the growing unrest in the country, and that the pressure for change – coming from all sides, including from the international community – would have to be dealt with politically.

Finally, the day which had to come, came. On 11 February 1990, Mandela walked out of the prison gates, and within days, established himself as the moral leader of the country. A remarkable achievement for a man who was not only banished for nearly three decades, but whose name, photograph and words it was a crime to publish! In May 1994, after four years of gruelling negotiations with the De Klerk government, Mandela was elected the political leader of the new South Africa, the first president of a democratic, non-racist society where the ex-oppressors live in peace with the majority whom they humiliated for centuries.



Cover of the UNESCO Courier, February 1992.

Mandela’s "10,000 days"

The twenty-seven years that Mandela spent in prison can be seen in two ways – as a terrible sacrifice of the best years of a man’s life, and a cruel price in absence and loss exacted from his family. This punishment is undeniable and immeasurable. But Mandela’s "10,000 days" behind bars, to use his own expression, can also be viewed on another timescale – this is how long it took for him to convince the racists to free themselves of their own ideological and cultural chains, to accept that freedom and dignity for all South Africans, whatever their colour or creed, were the ultimate qualifications of a civilized state.

The "white tribesmen" of Africa are lucky that Mandela waited those long years, that he was there to the bitter end in order to lead them, peacefully and patiently, out of the prison gates of their own minds – out of the delusion of separateness and superiority, to a land to which they can all belong and from which none can be expelled because of the colour of his skin.

Robben Island became the first South African national site to join the World Heritage List in 1999. If ever there comes into existence a world heritage list to name those who have expanded and uplifted the collective conscience of mankind, Nelson Mandela will have pride of place on it.

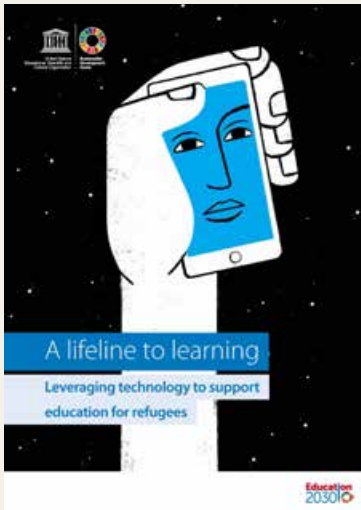
Director of the UNESCO Special Programme for South Africa from 1993 to 1996, **Annar Cassam** is from Tanzania.



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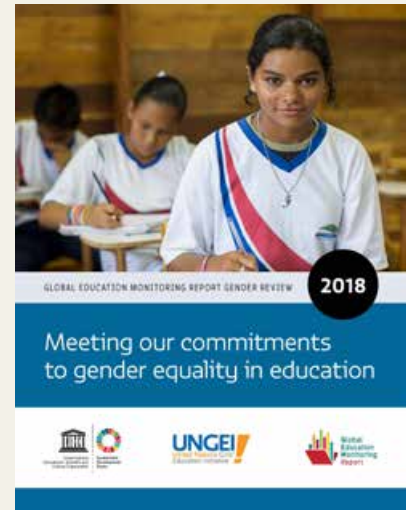
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The Courier is 70!

Celebrating science through its pages

