European Research Council
Conference

# Frontier Research and Artificial Intelligence

Brussels
25 / 26 October 2018

European Commission

**European Research Council**
Established by the European Commission

# About the ERC

The European Research Council, set up by the European Union in 2007, is the premiere European funding organisation for excellent frontier research. Every year, it selects and funds the very best, creative researchers of any nationality and age, to run projects based in Europe. The ERC has three main grant schemes: Starting Grants, Consolidator Grants and Advanced Grants. The Synergy Grant scheme was re-launched in 2017.

To date, the ERC has funded over 8 500 top researchers at various stages of their careers, and over 50 000 postdocs, PhD students and other staff working in their research teams. The ERC also strives to attract top researchers from anywhere in the world to come to Europe. Key global research funding bodies in the United States, China, Japan, Brazil and other countries have concluded agreements to provide their researchers with opportunities to temporarily join the teams of ERC grantees.

The ERC is governed by an independent body, the Scientific Council, led by the ERC President, Prof. Jean-Pierre Bourguignon. The overall ERC budget from 2014 to 2020 is over €13 billion, as part of the EU Research and Innovation framework programme Horizon 2020, for which European Commissioner for Research, Innovation and Science Carlos Moedas is responsible.

# Introduction

This conference is intended to take stock of relevant research supported by the European Research Council (ERC), to provide a forum between Principal Investigators leading ERC-funded projects, and to position ERC as contributor to Artificial Intelligence (AI) research through its bottom-up approach.

More specifically, it has the following aims: 1) to explore state of the art research related to AI; 2) to get a better understanding of likely benefits and potential threats of ever improving AI; 3) to highlight potential avenues for seizing the opportunities of AI whilst limiting negative effects for humanity.

# Background

Although definitions of Artificial Intelligence vary greatly, they usually refer to cognitive abilities exhibited by machines, such as problem-solving or learning, which result in behaviours that is commonly associated with humans behaviour[1]. Through recent advances in applications of AI such as autonomous driving, social robots and automated medical diagnosis, this area of study has received considerable attention not only among scientists, but also from policy makers, entrepreneurs and society at large.

As with all novel and potentially ground-breaking developments, the expectations connected with AI range from great optimism about the positive impact of technological progress to fears about how intelligent machines may harm societies. Although there is divergence as to the nature of the impact – given the improved capabilities of AI - there is a wide consensus that the technologies and concepts linked to AI will profoundly change the world as we know it today. A successful transition to a society where many important areas will be changed by the use of AI will require addressing the undoubted challenges lying ahead, but also ensuring that we can seize very promising opportunities for Europe and beyond.

As a result, explorations into the transformative potential of AI applications are taking place at all levels. The French Government, for example, presented a report[2] in March 2018, which summarises the state of the art and future trends. Taking into account the wide implications of the developments at hand, this report does not only focus on the national level but includes a European dimension. Similar activities are taking place in other European countries, such as Germany, where the government is currently developing a strategy, to be presented to the public at the Digital Summit 2018[3] on 3-4 December.  This kind of analysis and strategic planning is taking place all over the world, reinforcing the sense of urgency associated with the potential benefits of establishing a strong position in AI development[4].  Also, the European Union is tackling the issue head-on: not least because a report by the European Political Strategy Centre (EPSC) found that "It is widely expected that the next wave of innovation – in deep tech, Artificial Intelligence and robotics – will play to Europe's strength in science, engineering and industry[5]." In order to use these strengths to maximum effect, the European Commission released a communication in April 2018 which highlighted the need to join national efforts in a robust European framework allowing the EU to become a leader in what could be a revolution[6]. Specifically, three important goals have been identified: boosting the EU's scientific base, technological and industrial capacity, preparing for socioeconomic changes, and ensuring an appropriate ethical and legal framework. To support the implementation of the EU's strategy in this area, a High-Level Expert Group on Artificial Intelligence comprising representatives from industry, civil society, as well as academia, has been established[7].

Connecting to these efforts, the European Research Council Executive Agency (ERCEA) is devoting its annual conference to Artificial Intelligence. With its focus on scientific excellence and its bottom-up approach where scientists freely choose the subject they would like to study, the ERC is in a prime position to contribute to a broad discussion on AI at the frontier of knowledge. The conference will bring together leading scientists from Physics and Engineering, the Life Sciences as well as Social Sciences and Humanities, who are funded by the ERC. Each will briefly present their project and link their work to one of five thematic sessions, as well as to opportunities and challenges of AI more broadly. The intended result is a broad overview on state of the art frontier research on AI which seeks to contribute to ongoing discussions on how to shape Europe's future amidst rapid technological change.

# Conference contribution to the debate

## Foundations of Artificial Intelligence

Machine learning, neural networks and data science are key terms in the study and development of Artificial Intelligence. The conference will address underlying concepts and groundwork that is being done by ERC grantees for AI to unfold its full potential. How do key concepts such as rationality apply to AI? Where are the limits of supervised machine learning in terms of scalability and adaptability? And what about unsupervised learning: can robots overcome their limitations in dealing with new situations in unconstrained settings? New types of algorithms and software architectures open new areas for big-data to make an impact. But what are the challenges of a transition towards a data-driven way of running society, business and science?

## Artificial Intelligence and the brain

On the one hand, the study of the brain has informed the development of AI in important ways; on the other hand newly-gained AI capabilities have advanced our understanding of brain processes tremendously. The conference will explore this inter-relationship at different levels starting from low-level sensorial motor processes to highly complex cognitive processes such as consciousness. Is there even a possibility that the human brain and Artificial Intelligence may be connected in the future in order to alter our sensory experiences? How might the brain support wearable technology? What conditions are necessary for a person to experience an artificial limb as part of their body?

## The Ethics of Artificial Intelligence

The increasing implementation of AI in science and in our society creates many challenges. Social robots are employed more frequently, but little is known about the interaction with humans. Should we attribute mental states such as beliefs or intentions to artificial agents? And if we decide not to, how will robots work in social situations where interaction is important? ERC grantees are also investigating the potential of brain-computer interfaces to erase negative memories during sleep which may be helpful in treating post-traumatic stress disorders. Of course this raises the question of under which circumstances this should be allowed and what possible side effects could occur. Robots may soon be able to take over important tasks in caring for the elderly which may be perceived as good news for Europe's social systems under strain. Still, how would that affect elderly persons that would interact with robots on a daily basis?

## Apply AI: vision, mobility, language and science

Moving even further into the realm of AI usage, this session will highlight latest developments in some of the major applications of Artificial Intelligence. Can computer recognize and track moving objects or people? Can we build robots that are as resilient as animals? How can we use large-scale semantic AI to concentrate centuries of deep human thinking in a computer-understandable form and thereby learn more about how humans do mathematics and science?

## Artificial Intelligence and Society: where are we headed?

A number of ERC projects examine the use of Artificial Intelligence in key societal areas such as politics, social robotics, education and healthcare. The use of low-level Artificial Intelligence, specifically around elections to influence political opinion, has caught the attention of science and media alike. Is Artificial Intelligence employed by political groups making a decisive impact on who governs Western democracies? As mentioned, social robots are on the rise and the presence of humanoid robots in society grows, begging the question of how we can prepare for such a future (e.g. in education)? Some of those robots are currently tested for their use in educating primary school children – what will be the impact on these early adopters? Artificial Intelligence and big data will also change how we diagnose illnesses. The conference will thus hear about the potential of machine learning for much improved diagnostic capabilities in the case of type 1 diabetes.

# Closing remarks

ERC President Jean-Pierre Bourguignon will conclude the conference with a first impression of the rich programme and lessons learnt. This will provide the basis for a short conference report on "Frontier Research and Artificial Intelligence" that can feed into the ongoing AI discussion on a European and global scale.

(1) See e.g. Russell, Stuart J.; Norvig, Peter (2009). Artificial Intelligence: A Modern Approach (3rd ed.). Upper Saddle River, New Jersey: Prentice Hall, p. 2.
(2) "For A Meaningful Artificial Intelligence" https://www.aiforhumanity.fr/pdfs/MissionVillani_Report_ENG-VF.pdf, last access: 24/09/2018.
(3) "AI-Hub Europe Exclusive: German AI-Strategy Paper in English" http://ai-europe.eu/exclusive-german-ai-strategy-paper-in-english/, last access: 24/09/2018.
(4) "Artificial Intelligence Strategies" https://medium.com/politics-ai/an-overview-of-national-ai-strategies-2a70ec6edfd, last access: 24/09/2018.
(5) "Europe is back" https://ec.europa.eu/epsc/sites/epsc/files/epsc_europe_is_back_trends_jan.pdf, p. 2, last access: 24/09/2018.
(6) "Commission Communication: Artifical Intelligence for Europe" http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=51625, last access: 24/09/2018.
(7) "High-Level Expert Group on Artificial Intelligence" https://ec.europa.eu/digital-single-market/en/high-level-expert-group-artificial-intelligence, last access: 24/09/2018.

# Thursday 25 October 2018: 9.15 – 18.30

| 8.15-8.50 | **Registration** |

## Opening Session: Why Artificial Intelligence matters

Moderator: **Pablo Amor**, Director, ERCEA
Rapporteur: **Frank Kuhn**, Scientific Officer, ERCEA

| 9.15 | **Welcome Address** |
| | **Jean-Pierre Bourguignon**, President of the European Research Council (ERC) |
| | "ERC's contribution to Artificial Intelligence" |
| 9.25 | **Opening Address** |
| | **Signe Ratso**, Deputy Director-General for Research and Innovation, DG RTD |
| | "The EU's role in Artificial Intelligence" |
| 9.40 | **Scientific overview talk** |
| | **Michael Bronstein** |
| | "Frontier research and Artificial Intelligence: key areas and future prospects" |
| 10.00 | Q&A |
| 10.15 | Coffee break |

## Session 1: Foundations of Artificial Intelligence

Moderator: **Alejandro Martín-Hobdey**, Head of Call and Project Follow-up Coordination Unit, ERCEA
Rapporteurs: **Carlos Gálvez** and **Rafael Carrasco**, Scientific Officers, ERCEA

| 10.45 | **Simon Thorpe** |
| | "Memory Mechanisms in Man and Machine" |
| 11.05 | **Francis Bach** |
| | "Robust algorithms for learning from modern data" |
| 11.25 | **Barbara Caputo** |
| | "Robots learning about objects from externalized knowledge sources" |
| 11.45 | **Nello Cristianini** |
| | "Patterns in Big Data: Methods, Applications and Implications" |
| 12.05 | Q&A |
| 12.20 | Lunch break |

## Session 2: Artificial Intelligence and the brain

Moderator: **Carmen García-Fernández**, Acting Head of Life Sciences Unit, ERCEA
Rapporteurs: **Nicolas Voilley** and **Fotios Vikas**, Scientific Officers, ERCEA

| | |
|---|---|
| 13.20 | **Axel Cleeremans**<br>"The Radical Plasticity Thesis: How we learn to be conscious" |
| 13.40 | **Suliann Ben Hamed**<br>"Invasive cognitive brain computer interfaces to enhance and restore attention: proof of concept and underlying cortical mechanisms" |
| 14.00 | **Giacomo Indiveri**<br>"Neuromorphic Electronic Agents: from sensory processing to autonomous cognitive behavior" |
| 14.20 | **Tamar Makin**<br>"EmbodiedTech: Can humans embody augmentative robotics technology?" |
| 14.40 | Q&A |
| 14.55 | Coffee break |

## Session 3: The ethical challenges of Artificial Intelligence

Moderator: **Michel Vanbiervliet**, Head of Ethics Review and Expert Management Unit, ERCEA
Rapporteurs: **Abdul Thieme** and **Joel Le Deroff**, Scientific Officers, ERCEA

| | |
|---|---|
| 15.25 | **Jeroen van den Hoven**, Member of European Group of Ethics<br>"The ethical challenges of Artificial Intelligence" |
| 15.45 | **Agnieszka Wykowska**<br>"Intentional stance for social attunement" |
| 16.05 | **Karim Benchenane**<br>"Brain computer interface to study and manipulate memories of aversive experience during sleep" |
| 16.25 | **Carme Torras**<br>"CLOTH manipulation Learning from Demonstrations" |
| 16.45 | Q&A |
| 17.00 | Coffee break |
| 17.30 | **Introduction to Special Lecture**<br>**Eva Kaili**, Member of the European Parliament |
| 17.40 | **Special Lecture AI**<br>**Cédric Villani**, Member of the French Parliament<br>"The Artificial Intelligence strategy for France and Europe" |
| 18.10 | Q&A |
| 18.30 | End of sessions |

# Friday 26 October 2018: 9.00 – 13.00

## Session 4: Apply AI: vision, mobility, language and science

Moderator: **Martin Penny**, Head of Physical Sciences and Engineering Unit, ERCEA
Rapporteur: **Giovanni Felici**, Scientific Officer, ERCEA

| | |
|---|---|
| 9.00 | **Cristian Sminchisescu**<br>"Learning to See in a Dynamic World" |
| 9.20 | **Jean-Baptiste Mouret**<br>"Robots with animal-like resilience" |
| 9.40 | **Gemma Boleda**<br>"A distributional MOdel of Reference to Entities" |
| 10.00 | **Josef Urban**<br>"Artificial Intelligence for Large-Scale Computer-Assisted Reasoning" |
| 10.20 | Q&A |
| 10.35 | Coffee break |

## Session 5: Artificial Intelligence and Society: where are we headed?

Moderator: **Angela Liberatore**, Head of Social Sciences and Humanities Unit, ERCEA
Rapporteur: **Elena Patricia Núñez Castellar**, Scientific Officer, ERCEA

| | |
|---|---|
| 11.05 | **Philip Howard**<br>"Computational Propaganda: Investigating the Impact of Algorithms and Bots on Political Discourse in Europe" |
| 11.25 | **Emily Cross**<br>"Mechanisms and Consequences of Attributing Socialness to Artificial Agents" |
| 11.45 | **Jochen Peter**<br>"Children and social robots: An integrative framework" |
| 12.05 | **Laura Elo**<br>"From longitudinal proteomics to dynamic individualized diagnostics" |
| 12.25 | Q&A |
| 12.40 | Closing remarks by **Jean-Pierre Bourguignon**, President of the European Research Council (ERC) |
| 13.00 | End of conference |

# Moderators



Opening Session

## Pablo Amor

**Director European Research Council Executive Agency (ERCEA)**

Pablo Amor holds both B.S. and M.S. degrees in Electrical Engineering and he is a licensed Engineer in Spain, his home country. He also has an MBA degree from Stanford University with specialisation in both Finance and Public Management.

Prior to joining the European Commission, he worked for Procter & Gamble as European Network Manager responsible for the computer network operations of P&G at their European Headquarters in Brussels.

Pablo Amor is the Director of the European Research Council Executive Agency (ERCEA) since 1 January 2011. As a Commission official he has held posts in Washington as a Science Counsellor and in Montevideo where he participated actively in negotiations with Mercosur.



Session 1

## Alejandro Martín-Hobdey

**Head of Call and Project Follow-up Coordination Unit, ERCEA**

Alejandro Martín-Hobdey studied Physics at the University of Manchester and obtained a PhD in Nuclear Physics at the University of Rochester, USA. Following postdoctoral work at MIT on Laser cooling and Trapping of atoms, he was awarded a position as Research Scientist in 1988 at the Instituto de Óptica in Madrid, and then went on to work on medical physics as a Research Fellow at Harvard Medical School.

He has worked in several research programmes within the Directorate-General for Research and Innovation since joining the European Commission in 1994, including the New and Emerging Science and Technology (NEST) initiative of Framework Programme 6. He participated in the setting up of the European Research Council since its inception, having been the Head of Unit for the Starting Grants until October 2012. He is currently the Head of Unit for Call and Project Follow-up Coordination within the Scientific Department of ERCEA.



Session 2

## Carmen García-Fernández

**Acting Head of Life Sciences Unit, ERCEA**

Carmen García-Fernández is Acting Head of Unit for Life Sciences in the European Research Council Executive Agency (ERCEA). The unit manages the scientific evaluation of frontier research grant applications and monitoring of running ERC projects in the Life Sciences area. Before joining the ERCEA in 2009, she coordinated the Conservation and Sustainable Use of Forest and other Wild Species global programme at Bioversity International-FAO. Prior to that, she was a Research Fellow at the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), based in Brazil, and at the Center for International Forestry Research (CIFOR), based in Indonesia. She holds a PhD in Biology (Specialization in Tropical Forest Ecology) from the University Complutense de Madrid.

# Moderators

### Michel Vanbiervliet

**Head of Ethics Review and Expert Management Unit, ERCEA**

Michel Vanbiervliet is the Head of Unit for Ethics and Expert Management at the European Research Council Executive Agency. Before joining the ERC in 2009, he worked as commission official in DG ENTR and DG DEVCO, as Team Leader for the development of IT systems. Prior to joining the European Commission, he worked as process engineer for Volvo Cars and Volvo Trucks, and as IT project manager for a UK based company in logistics. He graduated in Electrical Engineering at Ghent University (Belgium) and completed his last year of studies at the University of Manchester (UK).

Session 3

### Martin Penny

**Head of Physical Sciences and Engineering Unit, ERCEA**

Martin Penny is the Head of Unit for Physical Sciences and Engineering in the ERCEA, having joined the Agency in July 2014 from DG Research and Innovation, in the European Commission, where he worked as the political assistant to the Director-General, Robert-Jan Smits. He was previously a Policy Officer in the International Cooperation Directorate in DG RTD, and also worked on the development of the specific programmes for FP7 and on the policy and technical aspects of the annual work programmes.

Before joining the European Commission, he worked for eight years for the UK Research Councils in Swindon and Brussels, including four years as the Director of the Research Councils' European Office (UKRO) and three years working for the Engineering and Physical Sciences Research Council. Martin has an academic background in Organic Chemistry and in Science and Society issues and held postdoctoral research positions at universities in the UK, USA and Belgium.

Session 4

### Angela Liberatore

**Head of Social Sciences and Humanities Unit, ERCEA**

Angela Liberatore is the Head of Unit on Social Sciences and Humanities at the European Research Council Executive Agency. Prior to this, she worked in DG RTD at the European Commission in the International Cooperation programme with focus on the European Neighbourhood, including the Middle East, and, previously, in the Social Sciences and Humanities programme on citizenship, governance, conflict resolution, and in the Environment programme with a focus on climate change.

She contributed to the preparation of the European Commission's White Paper on European Governance. Publications include 'Climate Change, Security and Peace: The Role of the EU'; 'Balancing security and democracy. Biometric politics in the European Union'; 'Democratising Expertise, Expertising Democracy'; 'The Management of Uncertainty: Learning from Chernobyl'. Angela holds a PhD in Political and Social Sciences (European University Institute) and a degree in Philosophy (University of Bologna).

Session 5

# Opening session:
# Why Artificial Intelligence matters

## Jean-Pierre Bouguignon

**President of the European Research Council**

Professor Jean-Pierre Bourguignon was the Director of the Institut des Hautes Études Scientifiques (IHÉS) from 1994 till 2013. This international research institute located near Paris, France, was built as the European counterpart of the Institute for Advanced Study in Princeton. He was also the first ERC Panel Chair in Mathematics, for Starting Grants.

A mathematician by training, he spent his whole career as a fellow of the Centre National de la Recherche Scientifique (CNRS). He held a Professor position at École Polytechnique from 1986 to 2012. From 1990 to 1992, he was President of the Société Mathématique de France and President of the European Mathematical Society from 1995 to 1998. He is a former member of the Board of the EuroScience organisation (2002-2006) and served on EuroScience Open Forum (ESOF) committees since 2004.

Professor Bourguignon received the Prix Paul Langevin in 1987 and the Prix du Rayonnement Français in Mathematical Sciences and Physics from the Académie des Sciences de Paris in 1997. He is a foreign member of the Royal Spanish Academy of Sciences. In 2005, he was elected honorary member of the London Mathematical Society and has been the Secretary of the mathematics section of the Academia Europaea. In 2008, he was made Doctor Honoris Causa of Keio University, Japan, and, in 2011, Doctor Honoris Causa of Nankai University, China.

## Signe Ratso

**Deputy Director-General for Research and Innovation, DG RTD**

Signe Ratso is Deputy Director-General for DG RTD of the European Commission since 1 March 2018. In this function her particular areas of responsibility include International Cooperation in Research and Innovation as well as R&I in Industrial Technologies and in the area of Transport.

Before joining DG RTD she worked in different senior management positions in DG TRADE since 2006. From 2011 to 2018 she was Director for Trade Strategy, Analysis and Market Access in DG TRADE. Previously (from 2007 to 2011) she was Director for WTO, legal matters and food-related sectors in DG TRADE, also covering OECD issues, export credits and export controls of dual use goods. After joining the Commission at the beginning of 2006, she held the post of Principal Adviser in DG TRADE for a year.

Previously, Signe Ratso worked as Deputy Secretary-General (from 1994 to 2005) at the Ministry of Economic Affairs and Communications of the Republic of Estonia. In this position she was responsible for all EU-related issues in the following policy areas: trade and industrial policy, energy, transport, telecommunications, information society, internal market affairs. During Estonia's accession negotiations she was responsible for negotiating six economic chapters.

She has two University degrees. In 1983 she graduated from Tartu University in Estonia as an English Philologist, in 1993 in International Trade and International Economics.

# Michael Bronstein

**Imperial College London, Full Professor of Informatics at USI Lugano, Switzerland**

*Principal Investigator, Consolidator Grant 2016 'Deep Learning on MANifolds and graphs'*

Michael Bronstein (PhD with distinction 2007, Technion, Israel) is a Professor at USI Lugano, Switzerland and Imperial College London, UK, where he holds the Chair in Machine Learning and Pattern Recognition and the Royal Society Wolfson Merit Award. During 2017-2018 he was a fellow at the Radcliffe Institute for Advanced Study at Harvard University. He holds or has held visiting appointments at Stanford, MIT, and Tel Aviv University. Michael's main research interest is in theoretical and computational methods for geometric data analysis. He authored over 150 papers, the book 'Numerical geometry of non-rigid shapes' (Springer 2008), and over 30 granted patents. He was awarded four ERC grants, two Google Faculty Research awards, the Amazon AWS Machine Learning award, and the Rudolf Diesel fellowship at TU Munich. He is a Fellow of IAPR, Senior Member of the IEEE, alumnus of the Technion Excellence Program and the Academy of Achievement, ACM Distinguished Speaker, World Economic Forum Young Scientist, and member of the Young Academy of Europe. In addition to academic work, Michael is an inventor and serial entrepreneur. He was a co-founder and technology executive at Novafora (2005-2009), and one of the chief technologists at Invision (2009-2012) developing low-cost 3D sensors. Following the multi-million acquisition of Invision by Intel in 2012, Michael has been one of the key developers of the Intel RealSense technology in the role of Principal Engineer. His most recent venture is Fabula AI, a startup dedicated to algorithmic detection of fake news.

# Session 1:
# Foundations of Artificial Intelligence

### Simon Thorpe

**Directeur de Recherche CNRS, CHU Hôpital Purpan, Toulouse, France**

*Principal Investigator, Advanced Grant 2016 'Memory Mechanisms in Man and Machine'*

Simon Thorpe studied Physiology and Psychology at Oxford where he also obtained his doctorate with Edmund Rolls in 1981. After a year in Canada he moved to Paris and was recruited by the CNRS in 1983. He moved to Toulouse in 1993 as a founding member of the CerCo (Brain and Cognition Research Center) of which he is now Director.

Much of his work has centred on understanding the phenomenal processing speed achieved by the visual system. Using innovative experimental techniques, he showed that even complex natural scenes are processed in 100-150 ms. Given the anatomical and physiological constraints he concluded that challenging object and sense categorisation tasks must be possible with a single feed forward pass though the several layers of processing between the retina and cortical areas such as the Inferotemporal cortex, a proposal confirmed by the recent remarkable success of convolutional neural networks trained with deep learning techniques. He also proposed that information must be encoded by the order in which neurons fire spikes, rather than their firing rates, and these ideas led him to create SpikeNet Technology in 1999, a startup that developed bio-inspired image processing technology. More recently, his interests have focused on how the brain stores sensory memories that can last for decades, despite the variability in the biological hardware. His team has developed learning rules that involve spiking neurons and binary synapses, and he is currently working on designs to implement such rules in inexpensive digital hardware.

### Francis Bach

**Département d'Informatique de l'École Normale Supérieure, Centre de Recherche INRIA de Paris, France**

*Principal Investigator, Consolidator Grant 2016 'Robust algorithms for learning from modern data'*

Francis Bach is a Researcher at INRIA, leading since 2011 the machine learning team which is part of the Computer Science Department at École Normale Supérieure. He graduated from École Polytechnique in 1997 and completed his PhD. in Computer Science at U.C. Berkeley in 2005, working with Professor Michael Jordan. He spent two years in the Mathematical Morphology group at École des Mines de Paris, then he joined the Computer Vision project-team at INRIA/École Normale Supérieure from 2007 to 2010. Francis Bach is primarily interested in machine learning, and especially in graphical models, sparse methods, kernel-based learning, large-scale convex optimization, computer vision and signal processing. He received a Starting Grant in 2009 and, in 2016, a Consolidator Grant from the European Research Council, and was awarded the INRIA young researcher prize in 2012, the ICML test-of-time award in 2014, as well as the Lagrange prize in continuous optimization in 2018. In 2015, he was program co-chair of the International Conference in Machine learning (ICML), and general chair in 2018. He is now co-editor-in-chief of the Journal of Machine Learning Research.

## Barbara Caputo

**Senior Researcher, Italian Institute of Technology (IIT), Italy**

*Principal Investigator, Starting Grant 2014 'Robots learning about objects from externalized knowledge sources'*

Barbara Caputo is Full Professor at the Department of Control and Computer Engineering of the University of Politecnico di Torino (PoliTo) and head of the Artificial Intelligence Division at the Center for Future Sustainable Technologies of the Italian Institute of Technology (IIT).  Her main research interest is to develop algorithms for learning, recognition and categorization of visual and multi-modal patterns for embodied intelligent systems. These features are crucial to enable them to represent and understand their surroundings, to learn and reason about it, and ultimately to equip them with cognitive capabilities. Her research is sponsored by the Swiss National Science Foundation (SNSF), the Italian Ministry for Education, University and Research (MIUR), the European Commission (EC), the European Research Council (ERC) and the Italian Presidency of the Council of Ministers (PDCM). She has published more than 120 papers in the areas of Visual Recognition, Multi-modal and Open-ended learning, Semantic Spatial Modeling and Adaptive control of prosthetic hands, and has served as area chair and keynote speaker at several conferences and events in the fields of Computer Vision, Machine Learning and Robotics.
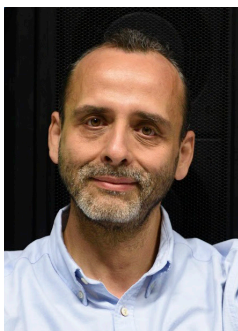
## Nello Cristianini

**Professor of Artificial Intelligence, University of Bristol, United Kingdom**

*Principal Investigator, Advanced Grant 2013 'Patterns in Big Data: Methods, Applications and Implications'*

Nello Cristianini is a Professor of Artificial Intelligence at the University of Bristol since March 2006, and a recipient of both an ERC Advanced Grant, and of a Royal Society Wolfson Merit Award. He has wide research interests in the areas of Data Science, Artificial Intelligence, Machine Learning, and applications to computational social sciences, digital humanities, news content analysis.

He has contributed extensively to the field of statistical AI. Before the appointment to Bristol he held faculty positions at the University of California, Davis, and visiting positions at the University of California, Berkeley, and in many other institutions. Before that he was a research assistant at Royal Holloway, University of London. He has also covered industrial positions. He has a PhD from the University of Bristol, a MSc from Royal Holloway, University of London, and a Degree in Physics from University of Trieste. He is co-author of the books 'An Introduction to Support Vector Machines' and 'Kernel Methods for Pattern Analysis' with John Shawe-Taylor, and "Introduction to Computational Genomics" with Matt Hahn (all published by Cambridge University Press).

# Session 2:
# Artificial Intelligence and the brain

## Axel Cleeremans

**Director, Centre for research in Cognition and Neurosciences (CRCN), Université Libre de Bruxelles, Brussels, Belgium**

*Principal Investigator, Advanced Grant 2013 "The Radical Plasticity Thesis: How we learn to be conscious"*

Axel Cleeremans is a Research Director with the Fonds de la Recherche Scientifique (F.R.S.-FNRS) and a professor of Cognitive Psychology at the Université libre de Bruxelles (ULB), where he heads the Consciousness, Cognition and Computation (CO3) Group and presides the ULB Neurosciences Institute. His research is essentially dedicated to the differences between information processing with and without consciousness, particularly in the domain of learning and memory, and more recently in the domains of Perception, Social Cognition, and Cognitive Control. Cleeremans argues that consciousness is the result of unconscious learning mechanisms through which the brain continuously redescribes its interactions with itself, with the the world and with other people. Cleeremans has acted as President of the European Society for Cognitive Psychology and is a board member of the Association for the Scientific Study of Consciousness. A member of the Royal Academy of Belgium, he is also Field Editor-in-Chief of Frontiers in Psychology. In 2015, he was awarded the prestigious Ernest-John Solvay prize for human sciences by the Belgian National Fund for Scientific Research. Axel Cleeremans has authored and edited several books as well as numerous articles dedicated to consciousness. He has edited, together with Tim Bayne and Patrick Wilken, the "Oxford Companion to Consciousness" (OUP 2009).

## Suliann Ben Hamed

**Head of Neural Basis of Perception and Action lab, Institute for Cognitive Science Marc Jeannerod, Bron, France**

*Principal Investigator, Consolidator Grant 2015 'Invasive cognitive brain computer interfaces to enhance and restore attention: proof of concept and underlying cortical mechanisms'*

Suliann Ben Hamed has an initial training in Mathematics, Physics and Biology at the École Normale Supérieure de la rue d'Ulm, in Paris, France. Subsequently she obtained a PhD on the visual neurophysiology of the parietal cortex, at the Collège de France, Paris. She went on with a first Post-doctoral research experience in Neuroanatomy, at the University of Medicine of Parma, Italy, and a second post-doctoral research experience in computational neurosciences, at the University of Rochester, USA. She was recruited at the CNRS in 2002 and joined the Institute of Cognitive Sciences (ISC, Lyon), created and directed by Marc Jeannerod. She is currently Research Director at the ISC, CNRS, where she heads a research group studying the neural bases of perception and action.

Her research aims to unveil how single neurons, as well as populations of neurons distributed in so-called functional networks, code information about the world and our internal mental life and coordinate to allow the brain to implement highly complex behaviors such as vision, attention and actions in space in a dynamic, flexible and optimal manner. She is currently developing cognitive attention-based brain machine interfaces and describing the underlying neuronal mechanisms associated with their control, to enhance and restore cognition. In particular, she has demonstrated the feasibility of a real-time access to the position of covert attention in space (Astrand et al., Current Biology, 2016). This work has a high translational potential, from fundamental research to applied clinical research.

## Giacomo Indiveri

**Neuromorphic Cognitive Systems group, Institute of Neuroinformatics, University of Zurich and ETH Zurich, Switzerland**

*Principal Investigator, Consolidator Grant 2016 'Neuromorphic Electronic Agents: from sensory processing to autonomous cognitive behavior'*

Giacomo Indiveri is a Professor at the Faculty of Science of the University of Zurich, Switzerland, director of the Institute of Neuroinformatics (INI) of the University of Zurich and ETH Zurich, and head of the Neuromorphic Cognitive Systems group at INI. Indiveri obtained an MSc degree in Electrical Engineering and a PhD degree in computer science from the University of Genoa, Italy. He received his Habilitation on Neuromorphic Engineering at ETH Zurich in 2006, was awarded an ERC Starting Grant in 2011, and an ERC Consolidator Grant in 2017. Engineer by training, Indiveri has always also been interested in Physics, Computer Science, and Neuroscience. He is currently combining these disciplines by studying real and artificial neural processing systems, and by building hardware neuromorphic cognitive systems, using full custom analog and digital VLSI technology. The neuromorphic circuits being developed by his group are designed to emulate the physics of computation of biological neural processing systems and are aimed at building efficient autonomous cognitive agents that can learn and reason about the actions to take in response to the combinations of external stimuli, internal states, and behavioral objectives. These are typically real-time behaving systems comprising neuromorphic sensors and multi-chip, multi-purpose spiking neural architectures. They are used to validate brain inspired computational paradigms in real-world scenarios, and to develop a new generation of fault-tolerant event-based neuromorphic computing technologies.

## Tamar Makin

**Associate Professor in Cognitive Neuroscience, Institute of Cognitive Neuroscience, Division of Psychology & Language Sciences, University College London, London, United Kingdom**

*Principal Investigator Starting Grant 2016 'EmbodiedTech: Can humans embody augmentative robotics technology?'*

Tamar Markin is a neuroscientist at UCL's Institute of Cognitive Neuroscience, heading the London Plasticity Lab. Her main interest is in understanding the key drivers and limitations of reorganisation in the adult brain. A particular focus is on how changed hand function, e.g. due to prosthesis usage or robotic fingers augmentation, shapes brain reorganisation. For this purpose, she integrate methods from the fields of neuroscience, experimental psychology and rehabilitation. A primary model for this work is studying individuals with a hand loss. She hopes her research will enable clinicians to guide amputees and related clinical populations to take advantage of the benefits of brain reorganisation, rather than to suffer from their adverse effects.

Tamar Markin graduated from the Brain and Behavioural Sciences programme at the Hebrew University of Jerusalem in 2009. She was then awarded several career development fellowships to establish her research program on brain plasticity in amputees at FMRIB, the Neuroimaging centre of the University of Oxford, first as Research Fellow and later as a Principle Investigator. In 2016 she joined the faculty of UCL to continue this work.

# Session 3:
# The ethical challenges of Artificial Intelligence

## Jeroen van den Hoven

**Professor of Ethics and Technology at the Delft University of Technology; founding Editor in Chief of Ethics and Information Technology, the Netherlands**

Jeroen van den Hoven is University Professor and Full Professor of Ethics and Technology at Delft University of Technology as well as Editor-in-Chief of Ethics and Information Technology (Springer/Nature). He was the founding Scientific Director of the 4TU Centre for Ethics and Technology (2007-2013). In 2009, he won the World Technology Award for Ethics, as well as the IFIP Prize for ICT and Society for his work in Ethics and ICT. Jeroen van den Hoven was founder, and until 2016 Programme Chair, of the Dutch Research Council Program on Responsible Innovation. Van den Hoven has received several grants from the Dutch Research Council on Responsible innovation. He has been advisor to the Dutch Government and the EU in various roles.

The European Commission has appointed Jeroen van den Hoven as a permanent member to the European Group on Ethics in Science and New Technologies (EGE). He will be one of the 15 high-calibre members who will advise the Commission on all areas of policy where ethical, societal and fundamental rights issues intersect with the development of science and new technologies. He is also seconded as such to the High Level Group of Experts on AI established in 2018 by the European Commission. Recently, he has published Information Technology and Moral Philosophy (CUP, 2008), Designing in Ethics (CUP, 2017) and Evil Online (Blackwell, 2018).

## Agnieszka Wykowska

**Italian Institute of Technology (IIT), Center for Human Technologies, Genoa, Italy**

*Principal Investigator, Starting Grant 2016 'Intentional stance for social attunement'*

Professor Agnieszka Wykowska leads the unit "Social Cognition in Human-Robot Interaction" at the Italian Institute of Technology (Genoa, Italy) and is also affiliated with the Luleå University of Technology, Sweden, as Adjunct Professor in Engineering Psychology. Prof. Wykowska studied Neuro-cognitive psychology (Ludwig Maximilian University, Munich) and philosophy (Jagiellonian University, Krakow). She obtained a PhD in Psychology and the German "Habilitation" from the Ludwig Maximilian University. She is an Associate Editor of Frontiers in Psychology (section Cognition) and of the International Journal of Social Robotics. She has been serving as Program Committee member for the conferences: "International Conference on Social Robotics", "Human-Robot Interaction", "Advanced Robotics and its Social Impacts". In 2013, she received an Early Stage Career Prize at the COST meeting "The future concept and reality of social robotics: challenges, perception and applications - role of social robotics in current and future society". In 2016 she was awarded the ERC Starting Grant "Intentional stance for social attunement", which focuses on Social Cognition in Human-robot interaction. In her research, she examines how humans respond to humanoid robots, and how to make robots' behaviour comprehensible for humans. Apart from contributions to social cognitive neuroscience, her research can inform the development of artificial intelligence for social robotics, and the design of robots for societal needs (healthcare, elderly care and daily assistance). In 2018 she participated in a meeting at the European Parliament "Investing in young researchers, shaping Europe's future", organised jointly by STOA (European Parliament's Science and Technology Options Assessment Panel) and the ERC.

# Karim Benchenane

**Full permanent CNRS Researcher, Team Navigation, Memory and Aging, in the Laboratory of Neurobiology of Adaptative Processes, University Pierre and Marie Curie, Paris, France**

*Principal Investigator, Consolidator Grant 2016 'Brain computer interface to study and manipulate memories of aversive experience during sleep'*

Karim Benchenane is a French researcher, leading the "Memory, Oscillations and Brain states" team within the Brain Plasticity Unit at the Higher School of Physics and Industrial Chemistry of the city of Paris (ESPCI).

He obtained his PhD in Molecular and Cellular Neuroscience from University de Caen – CNRS and did his post-doctoral research on the role of astrocytes in neuronal plasticity at Rutgers University, USA. Later on, he returned to France to conduct post-doctoral work at the Collège de France, Paris, to investigate the role of sleep in memory consolidation and interaction between hippocampus and prefrontal cortex. He currently holds a full permanent position at CNRS, Pierre and Marie Curie University in Paris and is now actively involved in the supervision of PhD students and in teaching activities. He is currently the recipient of an ERC Consolidator Grant, and has received several prizes and honors including the French Academy of Science AXA Prize for major advances in biological studies.

His research focuses on the influence of brain states and oscillations in information processing and memory and more precisely on the role of sleep. Using closed loop brain machine interfaces, he and his team have recently shown that it is possible to create artificial memories in mice. The researcher now proposes to continue experiments with aversive memories in his ERC project, and examine whether the same technique could be applied to them. Dr Benchenane aims to develop a tool for modifying memories to treat psychological conditions, for example post-traumatic stress disorder.

# Carme Torras

**Head of the Perception and Manipulation group at the Robotics Institute, Barcelona, Spain and Research Professor at the Spanish Scientific Research Council (CSIC)**

*Principal Investigator, Advanced Grant 2016 'CLOTH manipulation Learning from Demonstrations'*

Carme Torras is Research Professor at the Spanish Scientific Research Council (CSIC), and Head of the Perception and Manipulation group at the Robotics Institute in Barcelona. She received MSc degrees in Mathematics and Computer Science from the University of Barcelona and the University of Massachusetts - Amherst, respectively, and a PhD degree in Computer Science from the Technical University of Catalonia (UPC). She has published five books and about 300 papers in the areas of Robot Kinematics, Computer Vision, Geometric Reasoning, Machine Learning and manipulation planning. She has supervised 18 PhD theses and led 16 European projects, the latest being the Chist-Era project I-DRESS, the H2020 project IMAGINE, and her ERC Advanced Grant project CLOTHILDE – Cloth manipulation learning from demonstrations.

She is EurAI Fellow (2007), member of Academia Europaea (2010), and member of the Royal Academy of Sciences and Arts of Barcelona (2013). She has received the Dissemination Award of the Barcelona Science Museum, and the Narcís Monturiol Medal of the Generality of Catalonia.

Carme Torras is also a fiction writer and has published four novels in Catalan, for which she has been awarded several literary distinctions. Convinced that science fiction can help promote ethics in robotics and new technologies, one of her novels - winner of the Pedrolo and Ictineu awards - has been translated into English with the title 'The Vestigial Heart' (MIT Press, 2018) and published together with online materials to teach a course on Ethics in Social Robotics and AI.

# Special lecture

### Eva Kaili

**Member of the European Parliament, Member of the European Parliament's Committee on Industry, Research and Energy (ITRE) and of its Science and Technology Options Assessment (STOA) Panel**

Eva Kaili is an MEP and a member of the Group of the Progressive Alliance of Socialists and Democrats in the European Parliament. She is Chair of the STOA Panel, as well as Chair of the Delegation for relations with the NATO Parliamentary Assembly, a member of the ITRE Committee, and of the Conference of Delegation Chair. She has been working intensively on promoting innovation as a driving force of the establishment of the European Digital Single Market and has been particularly active in the fields of AI, blockchain technology, big data, fintech and cybersecurity. She has an undergraduate degree in Engineering from Aristotle University of Thessaloniki and a Master's degree in International Relations from the University of Piraeus, Greece, and has served as Member of the Greek Parliament from 2007 to 2012.

### Cédric Villani

**Member of the French National Assembly, rapporteur of the parliamentary mission on artificial intelligence, author of the report *'Donner un sens à l'intelligence artificielle. Pour une stratégie nationale et européenne'* for the French government**

Cédric Villani studied Mathematics in École Normale Supérieure in Paris, from 1992 to 1996. In 1998, he defended his PhD on the Mathematical Theory of the Boltzmann equation. From 2000 to 2010 he was a professor at École Normale Supérieure de Lyon, and later at the Université de Lyon. He occupied visiting professor positions in Atlanta, Berkeley and Princeton, USA. In 2009 he was the Director of the Institut Henri Poincaré in Paris; this 80-year old national institute, dedicated to welcoming visiting researchers, is at the heart of French mathematics. Since June 2017, he is an elected MP at the French National Assembly.

He has received several national and international prizes for his research, in particular the Fields Medal, awarded at the 2010 International Congress of Mathematicians in Hyderabad, India, by the President of India. His main research interests are in Kinetic Theory (Boltzmann and Vlasov equations and their variants), and Optimal Transport and its applications, a field in which he wrote two reference books: *Topics in Optimal Transportation (2003); Optimal Transport, old and new (2008)*. More generally, he is fond of subjects which combine the following themes: evolution partial differential equations, fluid mechanics, statistical mechanics, probability theory, smooth and nonsmooth "metric" Riemannian geometry, functional inequalities with geometric content.

Cédric Villani belongs to the editorial boards of *Inventiones Mathematicae, the Journal of Functional Analysis (JFA), the Journal of Mathematical Physics (JMP)* and *the Journal of Statistical Physics (JSP)*.

# Session 4:
# Apply AI: vision, mobility, language and science

### Cristian Sminchisescu

**Professor in the Department of Mathematics, Faculty of Engineering at Lund University, Sweden**

*Principal Investigator, Consolidator Grant 2014 'Learning to See in a Dynamic World'*

Cristian Sminchisescu is a Professor in the Department of Mathematics, Faculty of Engineering at Lund University, working in computer vision and machine learning. He has obtained a doctorate in computer science and applied mathematics with focus on imaging, vision and robotics at INRIA, under an Eiffel excellence doctoral fellowship of the French Ministry of Foregin Affairs, and has done postdoctoral research in the Artificial intelligence Laboratory at the University of Toronto. He holds a Professor equivalent title at the Romanian Academy and a Professor rank, status appointment at the University of Toronto, Canada, and advises research at both institutions. During 2004-07, he has been a Faculty member at the Toyota Technological Institute at the University of Chicago, and later on the Faculty of the Institute for Numerical Simulation in the Mathematics Department at Bonn University. Cristian Sminchisescu serves regularly as Area Chair for the major conferences in computer vision and machine learning (CVPR, ICCV, ECCV, AAAI), is a Program Chair for ECCV 2018, and a member of the Editorial Board (Associate Editor) of IEEE Transactions for Pattern Analysis and Machine Intelligence (PAMI). He has offered tutorials on 3D tracking, recognition and optimization at ICCV and CVPR, the Chicago Machine Learning Summer School, the AEFRAI Vision School in Barcelona, the Computer Vision summer school at ETH in Zurich and Prague, and Visum in Porto. He has authored over 100 technical publications. Over time, his work has been funded by the US National Science Foundation, the Romanian Science Foundation, the German Science Foundation, the Swedish Science Foundation, the European Commission under a Marie Curie Excellence Grant, and an ERC Consolidator Grant. Cristian Sminchisescu's research goal is to train computers to 'see' and interact with the world seamlessly, as humans do. His research interests are in the area of computer vision (human sensing, 3D reconstruction and recognition) and machine learning (optimization and sampling algorithms, structured prediction and kernel methods). The visual recognition methodology developed in his group was a winner of the PASCAL VOC object segmentation and labeling challenge over its past four editions, 2009-12, as well as winner in the Reconstruction Meets Recognition Challenge (RMRC) 2013-14. His work on deep learning of graph matching received the best paper award honorable mention at CVPR 2018.

### Jean-Baptiste Mouret

**Associate Researcher, Institut National de Recherche en Informatique et en Automatique, Paris, France**

*Principal Investigator, Starting Grant 2014 'Robots with animal-like resilience'*

Jean-Baptiste Mouret is the Principal Investigator of the ResiBots ERC grant, which is proposing novel machine learning algorithms to allow robots to adapt in minutes. With a PhD in Computer science obtained at the Pierre and Marie Curie University (UPMC, now Sorbonne Université), in Paris (2008), he has been an Assistant/Associate Professor ("maître de conférences") at the UPMC from 2008 to 2015, and has since joined the French Institute for Research in Computer Science and Automation (Inria), where he was appointed Senior Researcher ("Directeur de recherche") in 2017.

The work of Jean-Baptiste Mouret recently made the cover of Nature ("*Robots that can adapt like animals*", 2015) and has won a number of of awards, including the "*2017 ISAL Award for Distinguished Young Investigator in the field of Artificial Life*", the "*Prix La Recherche" (2016)*, and several best papers in international conferences.

## Gemma Boleda

**Head of the Computational Linguistics and Linguistic Theory (COLT) research group and tenure-track researcher, Department of Translation and Language Sciences of the Universitat Pompeu Fabra, Barcelona, Spain**

*Principal Investigator, Starting Grant 2016 'A distributional MOdel of Reference to Entities*

Gemma Boleda is the Principal Investigator of the AMORE ERC grant 'A distributional Model of Reference to Entities'. After a BA in Spanish Philology at Universitat Autònoma de Barcelona, she obtained a PhD in Cognitive Science and Language at Universitat Pompeu Fabra (Barcelona). Her post-doc life included the Department of Linguistics of The University of Texas at Austin, USA, and the CIMeC institute of the University of Trento, Italy. She now holds a Tenure-Track research position (Ramón y Cajal program) in the Department of Translation and Language Sciences of the Universitat Pompeu Fabra, where she heads the Computational Linguistics and Linguistic Theory (COLT) research group.

Gemma Boleda is in the standing review committee of the Transactions of the Association of Computational Linguistics (TACL) and Linguistic Issues in Language Technology (LiLT) journals and serves as an Information Officer in the ACL SIGSEM Board. Her main research area is Computational Linguistics (Natural Language Processing), with a focus on quantitative and computational methods for the analysis of language. She is currently working on reference, or how we use language to talk about the world; her team won the international SemEval 2018 Task 4 competition on a referential task. The AMORE project is currently hosting an Artistic Residency, funded by the VERTIGO STARTS program to facilitate cross-fertilization of art and technological projects.

## Josef Urban

**Principal Researcher at the Czech Institute of Informatics, Robotics and Cybernetics (CIIRC), Czech Technical University, Prague**

*Principal Investigator, Consolidator Grant 2014 'Artificial Intelligence for Large-Scale Computer-Assisted Reasoning'*

Josef Urban's interests include Automated Reasoning, Formal Verification and Machine Learning. In particular, he is interested in development of combined inductive/learning and deductive/reasoning "strong AI" methods and systems over large formal (fully semantically specified) knowledge bases. Examples are large corpora of formally stated definitions, theorems and proofs in mathematics, software verification and related fields. He has made such corpora available to the AI methods, created the first benchmarks, and developed first approaches and systems combining learning and reasoning over such corpora in various feedback loops. The systems developed by him and his colleagues have won several competitions and the methods today assist formal verification in proof assistants. He has also co-developed the first learning/reasoning systems for automated formalization of informal mathematics, and co-founded the conference on Artificial Intelligence and Theorem Proving (AITP). He received his MSc in Mathematics and PhD in Computers Science from the Charles University in Prague, worked as an Assistant Professor in Prague, and as a researcher at the University of Miami, USA, and Radboud University Nijmegen, the Netherlands.

# Session 5:
# Artificial Intelligence and Society: where are we headed?

### Philip Howard

**Director, Oxford Internet Institute and a statutory Professor of Internet Studies at Balliol College at the University of Oxford, United Kingdom**

*Principal Investigator, Consolidator Grant 2014 'Computational Propaganda: Investigating the Impact of Algorithms and Bots on Political Discourse in Europe'*

Philip N. Howard (BA Toronto, MSc LSE, PhD Northwestern) is the Director of the Oxford Internet Institute and a statutory Professor of Internet Studies at Balliol College at the University of Oxford. He has published eight books and over 120 academic articles and public essays on information technology, international affairs and public life. Howard's books include The Managed Citizen (Cambridge, 2006), the Digital Origins of Dictatorship and Democracy (Oxford, 2010), and most recently Pax Technica: How the Internet of Things May Set Us Free or Lock Us Up (Yale, 2015).

### Emily Cross

**Professor, Institute of Neuroscience, University of Glasgow, United Kingdom**

*Principal Investigator, Starting Grant 2015 'Mechanisms and Consequences of Attributing Socialness to Artificial Agents'*

Emily Cross is a Professor of Social Robotics at the University of Glasgow's Institute of Neuroscience and Psychology, where she directs the Social Brain in Action Lab and serves as the PI on the ERC Starting Grant 'Social Robots'. In these roles, she leads a vibrant team exploring experience-dependent plasticity in the human brain and behaviour, with a particular interest in how social experience or expectations about artificial agents shape how we perceive and interact with robots, and the neurocognitive consequences of engaging with robots across the lifespan and across cultures. Her research tools include functional magnetic resonance imaging (fMRI), transcranial magnetic imaging (TMS), transcranial direct current stimulation (tDCS), reaction time measures, and behavioural training paradigms. Emily completed undergraduate training in Psychology and Dance, USA, an MSc in cognitive psychology as a Fulbright Fellow in New Zealand, and a PhD in cognitive neuroscience at Dartmouth College, USA, before undertaking postdoctoral training at the Max Planck Institute for Cognitive and Brain Sciences, Germany, and faculty positions at Radboud University Nijmegen, the Netherlands, and Bangor University, UK. Her research has been supported by a number of national and international funding bodies, including the National Institutes of Health, USA, Alexander von Humboldt Foundation and VolkswagenStiftung, Germany, Netherlands Organisation for Scientific Research, Economic and Social Research Council, UK, Ministry of Defence, UK, and the European Commission.

## Jochen Peter

**Professor in the Amsterdam School of Communication Research, ASCoR, University of Amsterdam, the Netherlands**

*Principal Investigator, Consolidator Grant 2015 'Children and social robots: An integrative framework'*

Jochen Peter (MA, 1998, Johannes-Gutenberg Universität Mainz, Germany; PhD, 2003, Universiteit van Amsterdam, the Netherlands) is a Full Professor at the Amsterdam School of Communication Research, ASCoR, at the University of Amsterdam (since 2011). Between 2003 and 2010, he worked at the University of Amsterdam as a postdoc as well as an Assistant and Associate Professor. From 2013 to 2018, he was the Scientific Director of ASCoR. In 2009, Jochen was awarded the Young Scholar Award of the International Communication Association (ICA), the world's largest academic communication association, for outstanding early career research. He received, in 2005, a competitive Veni grant from the Dutch National Science Foundation (NWO), and in 2009 a prestigious Vidi grant from the same organization. In 2016, he was awarded an ERC Consolidator Grant. To date, his research has received numerous awards from national and international scientific organizations. Jochen has published more than 100 journal articles and book chapters. His research focuses generally on how young people's use of new communication technologies affects their psycho-social development. In his earlier research, Jochen investigated in particular the impact of the then emerging social media on teenagers' sociality. He also studied whether sexually explicit material on the internet influences adolescents' sexual attitudes and behavior. In his ERC Consolidator Grant, he specifically deals with the antecedents and consequences of children's interaction with social robots.

## Laura Elo

**Adjunct Professor in Biomathematics at University of Turku and Research Director in Bioinformatics at the Turku Centre for Biotechnology, University of Turku and Åbo Akademi University, Finland**

*Principal Investigator, Starting Grant 2015 'From longitudinal proteomics to dynamic individualized diagnostics'*

Laura Elo is the Principal Investigator of the DynaOmics ERC Grant (From longitudinal proteomics to dynamic individualized diagnostics). She holds a PhD in Applied Mathematics (Department of Mathematics, University of Turku, Finland, 2007). Since 2011, she has been Adjunct Professor in Biomathematics at University of Turku and since 2014 Research Director in Bioinformatics at the Turku Centre for Biotechnology, University of Turku and Åbo Akademi University. Her research group of around 30 members has backgrounds in Mathematics, Statistics, Computer science, Bioinformatics, Biology and/or Medicine. The group develops computational data analysis tools and mathematical modelling methods for analyzing and interpreting data generated by modern high-throughput biotechnologies. A specific focus is on biomedical applications in close collaboration with experimental and clinical groups to enable robust and reproducible interpretation of the molecular as well as clinical data. The ultimate goal is to improve the diagnosis, prognosis and treatment of complex diseases, such as diabetes and cancer. Her interdisciplinary collaborations have given her wide expertise in computational systems in biology and biomedical research, enabling her to perform high-quality international research with significant scientific impact and innovation. Using statistical modelling and advanced machine learning, her group has e.g. identified early markers for type 1 diabetes, prognostic markers for cancer and developed several powerful computational models for predicting disease and treatment outcomes.

"The European Research Council has, in a short time, achieved world-class status as a funding body for excellent curiosity-driven frontier research. With its special emphasis on allowing top young talent to thrive, the ERC Scientific Council is committed to keeping to this course. The ERC will continue to help make Europe a power house for science and a place where innovation is fuelled by a new generation."

Jean-Pierre Bourguignon
ERC President and Chair of its Scientific Council

## European Research Council
Established by the European Commission

https://erc.europa.eu

EuropeanResearchCouncil

@ERC_Research

Horizon 2020
European Union funding
for Research & Innovation