

UKRI  
**Trustworthy  
Autonomous  
Systems Hub**



UK Research  
and Innovation

UNIVERSITY OF  
**Southampton**



The University of  
**Nottingham**

UNITED KINGDOM • CHINA • MALAYSIA

**KING'S**  
*College*  
**LONDON**

# ANNUAL REPORT 2021

# Table of Contents

Foreword by the TAS Hub Board Chair	4
The Director’s Vision	5
Executive Summary	6
About Us	7
Our Vision	7
Our Mission	8
Management Structure	10
Executive Management Team	11
TAS Board	12
Programme Co-ordination Group	13
Strategic Advisory Network	14
International Scientific Committee	15
Management Team	16
Research and Engagement Committee	18
Node Liaison Committee	20
Sector Leads Committee	21
Skills Committee	22
Operations Team	23
Research Team	24
TAS Nodes	34
Research Programmes	37

Current research projects	37
Autonomous vehicles	38
Health and care	39
Defence and security	42
AI ethics and governance	42
Our Mission	8
Defence and security	42
AI ethics and governance	42
Landscape mapping	44
Skills Programme	45
Doctoral Training Network (DTN)	45
Syllabus Lab	45
Outreach	46
Partner Engagement	46
Hub Partners	47
Adopter Engagement	48
Community Engagement	48
Policy Engagement	49
Creative Engagement	51
The Future	52
Appendix	53
Our definitions	53



# Foreword by the TAS Hub Board Chair

In recent years, we have seen a growing awareness of the potential for automated and artificially intelligent technologies to yield disruptive, uneven, and inequitable effects, even as we have become more alive to their possibilities. Few will forget the sight of high-school students across the United Kingdom protesting the “algorithm” which calculated their attainment levels in the absence of exams suspended during the pandemic. And few will deny that, in the aftermath of the Ofqual quagmire, a widespread acceptance has emerged that a social licence for algorithmic and automated technologies will hinge on the presence of “public trust.”

The recovery from the pandemic, assuming it is coming to an end, will raise new global challenges alongside others that have not gone away: climate change, online harms and information manipulation, security, racial discrimination etc. Technologists would typically go down the easy, but ethically fraught, route of asking: how can tech fix this? This tech-push approach is stereotypical of Silicon Valley startups but is also familiar in research. Another, arguably better, way to approach such problems is to look at the needs of the communities, the changes we seek to make, and the impacts such changes may have on those using a particular technology, and others who are unintentionally affected by them. By iterating such a process, we may be able to build technology that is more sustainable and ethical.

But what is “public trust” and how do we build, uncover, or grow it? Professor Onora O’Neill cautions against a focus on increasing trust; after all, distrust is an important protective mechanism, not to mention often well-deserved. Professor O’Neill instead encourages an emphasis on trustworthiness, engendered by standards of practice, the development of institutional cultures, and the presence of human characteristics such as integrity, reliability, and competence. Through a lens of trustworthiness, we are cautioned not only to look at the technology itself, but the socio-technical systems of infrastructure, standardisation, assurance, regulation, governance, verification, and accountability which surround it.

autonomous technologies in its endeavour to understand and develop best practices to enable the development of autonomous systems that are both trustworthy in principle and trusted in practice. The research it funds and undertakes addresses challenges which arise across the breadth of socio-technical systems which comprise the autonomous technologies landscape, and brings in researchers from backgrounds as diverse as genomics, law, human computer interaction, engineering, psychology, and communications. That the portfolio of research projects maintained by the TAS Hub includes, prominently, projects which speak to the ethics, governance and regulation of autonomous systems and AI is not only encouraging from my perspective as Director of the Ada Lovelace Institute, but an important reiteration of UKRI’s holistic approach to supporting AI and autonomous systems research.

The interdisciplinary scope of the Hub is echoed in the composition of the TAS Hub Board, which I am proud to chair, and in which social scientists and lawyers sit alongside computer scientists and engineers. If we have any significant role to play in this far-reaching research endeavour, it is to continue to encourage the Hub to pursue a systems-oriented, interdisciplinary, and holistic approach to thinking about and researching trustworthiness and its relationships with autonomous and artificially intelligent technologies.

I look forward to seeing what this exciting initiative will deliver in the coming years.

Carly Kind FIET  
Director, Ada Lovelace Institute,  
UKRI TAS Hub Board Chair



# The Director's Vision



## Director's vision

The world has suffered dramatic geopolitical, economic, and societal challenges over the last two years. At the time when the Trustworthy Autonomous Systems Programme was conceptualised by UKRI, no one had imagined that we would be launching the programme through online platforms, having to take charge of our children's education at home, and living in constant worry of a viral infection in crowded places. Amid the pandemic and economic downturn, research teams led by Prof. Dame Sarah Gilbert and Uğur Şahin rose to the challenge to produce the vaccines that have now slowed the pandemic and saved countless lives and livelihoods in communities around the world. The speed and efficacy with which the vaccine was created and deployed is largely the result of a unique mix of creativity, close industry-academia collaboration, and public engagement. However, the adoption of vaccines by the underprivileged and communities on vaccines has been met by economic and moral challenges, as governments and industry argue over the mechanisms for equal and fair access to all countries in the world. This goes to show how, in a live setting, experienced by all publics, it is so difficult to translate life-saving research into real-world outcomes.

The recovery from the pandemic, assuming it is coming to an end, will raise new global challenges alongside others that have not gone away: climate change, online harms and information manipulation, security, racial discrimination etc. Technologists would typically go down the easy, but ethically fraught, route of asking: how can tech fix this? This tech-push approach is stereotypical of Silicon Valley startups but is also familiar in research. Another, arguably better, way to approach such problems is to look at the needs of the communities, the changes we seek to make, and the impacts such changes may have on those using a particular technology, and others who are unintentionally affected by them. By iterating such a process, we may be able to build technology that is more sustainable and ethical.

Machines based on artificial intelligence and robotics will play a significant role, no doubt, in the recovery process and in addressing these global challenges. Their ability to process masses of data, automate vehicle navigation, map out proteins, make them far superior to humans in some settings and will result in innovative and impactful products in a range of sectors. But as they become embedded within our work practices and daily activities, they will start influencing our decisions and, in some cases, autonomously make such decisions on our behalf. To ensure we realise the benefits of autonomous systems involving both humans and machines, they will need to be trusted by the public, industry, and the government and be safe, reliable, and resilient in various environments.

The TAS Hub is a programme that adopts Responsible Research and Innovation (RRI) and Equality, Diversity, and Inclusivity (EDI) principles to deliver the best practices that will enable the development of autonomous systems that are both trustworthy in principle and trusted in practice. The Hub will generate a highly responsive research project portfolio where projects are created as part of sprints, through engagements with industry, government, and the public. We have constructed a diverse research team (in gender, cultural background, discipline) and established processes to engage our community in adopting and generating best practices. It is only the beginning and we look to continuously improve over the duration of the programme.

The TAS Hub has initiated 18 community-driven projects worth around £3m, situated in four application areas so far: Autonomous Vehicles, Health and Care, Defence and Security, AI Ethics and Governance. It has also initiated its Creative Engagement programme through four artist-in-residence projects and a co-developed gallery at the National Gallery X. These projects were created by a diverse community of researchers from different disciplines (Computer Science, Engineering, Social Sciences, Law etc.). The Hub also brings together over 65 industrial partners, many of which are directly contributing to these projects and look to exploit their outputs over the next 3 years. As we come to the end of our first twelve months, we aim to build upon this momentum to address the most pressing challenges our society faces, while also looking to develop the UK's economic edge globally. To this end, we will be announcing our next call for pump priming projects along three key application areas: (i) The transition to net zero (ii) Post-pandemic recovery (iii) Inclusion. By so doing we look to ensure that autonomous systems are built for the purpose of improving quality of life and sustainability for all and not only those who can afford the technology.

We also endeavour to ensure that the public is aware of the new issues AS will create; how AS will affect their privacy and autonomy among others. Through our policy and public engagement initiatives, we are constantly contributing to government policy and directly talking to diverse publics to internalise their concerns about future autonomous systems into our research. We will also be growing the impact of the Hub through our Skills programme that aims to translate research outputs into training and educational material that will shape the workforce across different disciplines and industries.

We look forward to working with one and all to drive the Hub's programme forward.

Gopal Ramchurn FIET  
Director, UKRI TAS Hub



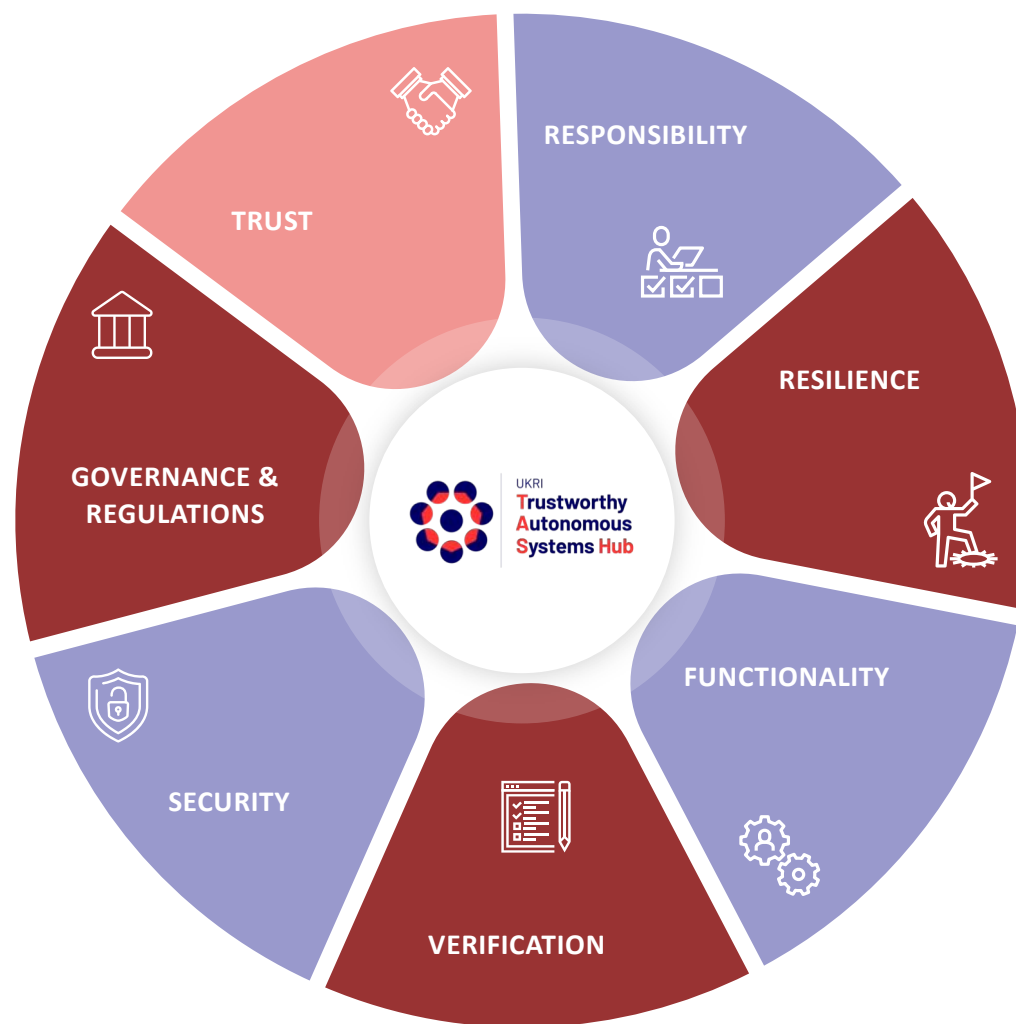
# Executive Summary

The UKRI Trustworthy Autonomous Systems Programme is a 4-year multi-disciplinary research programme worth £33m funded by UKRI through the Strategic Priorities Fund. It is the world's largest research programme in Trustworthy AI and Autonomous Systems. The vision of the programme is to enable the development of socially beneficial autonomous systems that are trustworthy in principle and trusted in practice by the public, government, and industry.

The TAS Programme currently involves over 20 Universities, more than 130 researchers from over 10 disciplines engaging with over 180 Industry Partners.

The UKRI Trustworthy Autonomous Systems Hub (TAS Hub) is led by the University of Southampton, with partners from the University of Nottingham and King's College London. The TAS Hub sits at the heart of the programme, with a budget of £11.7m, and assembles a diverse and multi-disciplinary team of researchers and industry partners, and government representatives. Six TAS Nodes and three smaller projects were also funded as part of the programme (between £2.5-£3.5m each to last 42 months) to focus on the following core areas: Governance and Regulation, Trust, Resilience, Functionality, Security, and Verifiability.

Working with the TAS Nodes, the TAS Hub coordinates the TAS programme to deliver world-leading responsible research and innovation via a collaborative international platform.





# The Nodes



The Functionality node will investigate how we can create processes that will build trust in autonomous systems, rather than just building the technologies themselves.



The Governance and Regulation node will develop a novel framework for the certification, assurance, and legality of TAS and will address whether such systems can be used safely.



The Resilience node will develop a comprehensive toolbox of principles, methods, and systematic approaches for the engineering of resilient autonomous systems.



The Security node will examine key issues surrounding security as autonomous systems are used in an increasingly diverse range of applications.



The Trust node is investigating how to build, maintain and manage trust in robotic and autonomous systems.



The Verifiability node provides a focal point for verification research in the area of autonomous systems, linking to national and international initiatives.

## About Us

The TAS Hub brings together a world-leading diverse multi-disciplinary team with national and international research and advocacy experience, and leadership of many successful research programmes. The Hub builds on a strong cross-institutional core team from the Universities of Southampton, Nottingham, and King's College London who have worked together for over a decade. The team has had 5 joint EPSRC (Engineering and Physical Sciences Research Council) projects, produced over 65 co-authored publications (including multiple best-paper awards), jointly organised multiple international workshops and conferences, and trained over 150 PhD students in multi-disciplinary research. The team is balanced in terms of disciplines, gender, cultural background, and career level. The members' diverse yet complementary domains of expertise will allow us to deliver the proposed broad and interdisciplinary programme of translational research and impact. Each member has a management role within the Hub's activities of Research, Outreach, and Skills. These programmes seek to support the delivery of our vision and mission.







## Our Vision

“To enable the development of socially beneficial autonomous systems that are both trustworthy in principle and trusted in practice by the public, government, and industry.



# Our Mission

## The UKRI TAS programme will:

1. **Deliver a coherent and responsive research programme** for the TAS community to ensure the TAS programme generates world-leading research.
2. **Cohere** a multi-disciplinary academic community and industry experts through projects to address both social and technical challenges in the design, regulation, and operation of trustworthy and socially beneficial autonomous systems.
3. **Support dialogues** with a diverse set of stakeholders, including government, industry, and the public to:
  - define the research challenges we will address.
  - inform their decisions and present the risks they may be exposed to.
  - respond to the UK's economic, environmental, and social challenges as they arise.
4. **Train** the next generation of TAS designers ranging from legal experts to engineers that are well versed in responsible innovation.
5. **Create an inclusive environment** open to a diversity of views, and encourages creative, adventurous, and responsible, research and innovation.

## Our Guiding Principles



### COLLABORATION IS OPEN TO ALL

As a national centre we are open to collaboration with research organisations, government, NGOs, SMEs, industry, and the wider public.



### INCLUSIVE AND RESPONSIBLE RESEARCH

We will promote research that take careful deliberation and broad engagement to reflect on its intentions, design, risks, and potential societal concerns.



### NURTURING A DIVERSE RESEARCH COMMUNITY

We will create an inclusive and accessible working environment and will put in place mechanisms that help provide fair and equal opportunities for all members of the TAS community.



### OPENNESS

We advocate the principles of open science, aiming to make our research outputs transparent and accessible, including open access, open data, open source etc.



### LISTENING AND ENGAGING

A dialogue with stakeholders, policy makers, and the general public is critical to develop a multi-perspectival approach to developing TAS that is responsive to society's demands as they arise.



### STRIVING FOR EQUAL VOICES

We will provide spaces to ensure all voices from within the TAS community are heard regardless of seniority or loudness, and that views can be expressed, challenged, and debated in a constructive and respectful way.



### WORKING ACROSS DISCIPLINARY PERSPECTIVES

We will nurture and promote a culture of respect and understanding of different disciplinary perspectives to ensure a holistic view in addressing the challenges of designing, using, and regulating autonomous systems.



### PROMOTING CREATIVITY

We encourage risky and adventurous approaches to develop new perspectives, or to create engaging and critical experiences for the public by working with the Arts and the creative sector.



### REVIEWING RESEARCH FAIRLY

We will adopt peer review standards and best practices to assess and drive the work of the programme, from the selection of early ideas for development, to the assessment of proposals.

# Management Structure

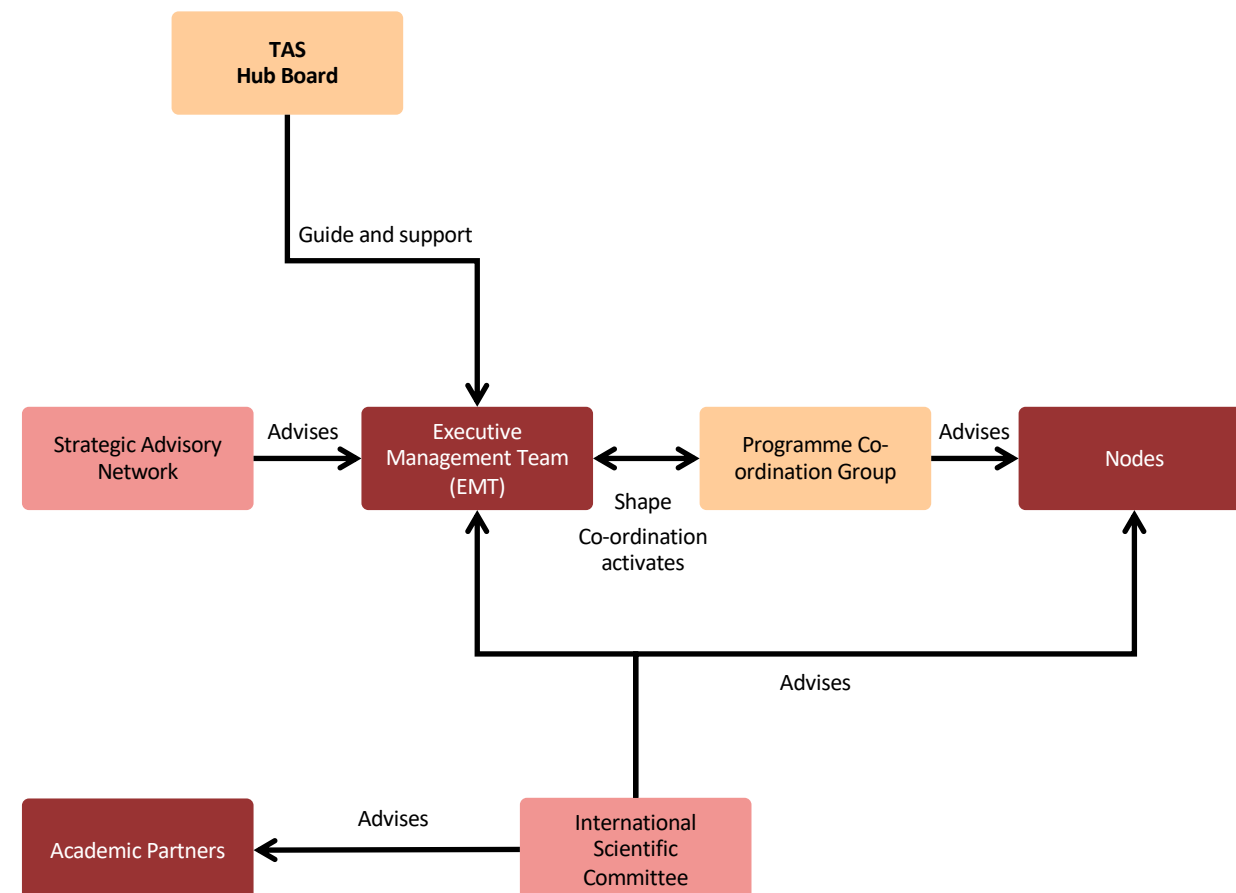
Our research programmes seek to establish and consolidate a culture for responsible research and innovation (RRI) and embed equality, diversity, and inclusion (EDI). With this in mind, we have developed our TAS Guiding Principles:

While the TAS Hub benefits from a formal management structure including executive (see Governance Structure below) and operations teams, it adopts a flexible and inclusive management approach that is key to success in delivering a modern large-scale, multi-partner and multi-disciplinary endeavour. The Hub is directed by Professor Sarvapali (Gopal) Ramchurn at the University of Southampton. His role spans research leadership - fusing a shared vision across the TAS Programme; ambassadorial -

communicating this vision to a wide range of audiences; and operational - leading the Executive Management Team (EMT). The EMT work in an agile way, using online collaboration tools (e.g., Office 365, Slack and ERPNext) and inviting experts within and beyond the TAS programme to ensure coverage of challenges that arise due to node topics and disciplinary foci. Team meeting reports are summarised and disseminated on our collaboration platform to seek rapid feedback, ensuring the direction of travel is always responsive to the TAS community's needs, contingencies, and opportunities arising.



## UKRI TAS Hub Governance Structure



The Hub Governance and advisory boards, outlined below, provide the Executive Management Team with guidance and advice on the direction of the Programme and challenge the team. It is through regular meetings that these committees help the Hub to set out strategic direction and foundation for all our activities.

The Executive Management Team are supported in their operational delivery of the Hub by the Research and Engagement, Node Liaison, Sector Leads and Skills Committees. An overview of these operational committees is also provided below.



# Executive Management Team

## Chair



**Professor Sarvapali. D (Gopal) Ramchurn**

UKRI TAS Hub Director

## Members

Dr Kate Devlin, Advocacy and Engagement Director (from Sep. 2021)

Professor Susan Gourvenec, Advocacy and Engagemnent Director (until Sep. 2021)

Dr Joel Fischer, Research Director

Professor Dame Wendy Hall, Skills Director

Professor Derek McAuley, Deputy Director

Professor Luc Moreau, Deputy Director

Dr Elvira Perez, Responsible Research, and Innovation (RRI) Director

Professor Sarah Sharples, Equality, Diversity, and Inclusion (EDI) Director

Angela Westley, Head of Operations

Dr Ben Coomber, Operations Team

## Role

The Executive Management Team (EMT) is responsible for the day-to-day management of the TAS Hub. It ensures the quality and efficient running of the Hub's research, outreach, and skills programmes.

The EMT is supported by the Operations Team consisting of the Head of Operations, Projects Manager, Transformation Manager, Skills Manager, and an administrator based at Nottingham and King's respectively.

# TAS Board

## Chair



**Carly Kind**

Director, Ada Lovelace Institute

## Members

Dr Indra Joshi, Director of AI, NHS X

Professor Derek McAuley, Deputy Director UKRI TAS Hub

Dr Victoria Mico-Egea, UKRI Programme Manager

Professor Luc Moreau, Deputy Director UKRI TAS Hub

Dr Marion Oswald, University of Northumbria

Professor Gopal Ramchurn, Director UKRI TAS Hub

Professor Tom Rodden, CSA for the Dept. for Culture, Media and Sport

Dr Jack Stilgoe, University College London

Angela Westley, Head of Operations UKRI TAS Hub

Dr Alvin Wilby

Adrian Woolard, British Broadcasting Company (BBC)

## Role

The TAS Board's role is to guide and support the Hub's Executive Management Team in their management and delivery of the Programme, including identifying impact opportunities to accelerate the adoption of research developed.

# Programme Co-ordination Group

## Chair



**Professor Sarvapali. D (Gopal) Ramchurn**

UKRI TAS Hub Director

## Members

Professor Helen Hastie, Trust Node

Dr Radu Calinescu, Resilience Node

Professor Mohammad Reza Mousavi, Verifiability Node

Professor Subramanian Ramamoorthy, Governance and regulation Node

Professor Neeraj Suri, Security Node

Dr Shane Windsor, Functionality Node

Dr Victoria Mico-Egea, UKRI Programme Manager

Angela Westley, Head of Operations UKRI TAS Hub

## Role

This group provides the executive-to-executive co-ordination of all TAS (Hub and Node) programmes. It offers relevant insight into the national and international research landscape and identifies opportunities for new collaborations and impact opportunities to accelerate the adoption of research developed.

# Strategic Advisory Network

## Chair



**Henry Tse**

Director of New Mobility Technologies,  
Connected Places Catapult

## Members

- |  |  |
|--|--|
| Brhmie Balaram, NHSX                         | Mohammad Mesgarpour, Microlise   |
| Irakli Beridze, UNICRI                       | Luc Moreau, Deputy Director, UKRI TAS Hub                                    |
| Nik Bhutani, Northrop Grumman                | Shamma Mustapha, Boeing  |
| Ben Coomber, UKRI TAS Hub Operations Team    | Elvira Perez, Responsible Research, and Innovation<br>Director, UKRI TAS Hub |
| Hector Figueiredo, Qinetiq                   | Robert Skilton, UKAEA  |
| Joel Fischer, Research Director UKRI TAS Hub | Peter Stockel, Dstl  |
| Darminder Ghataoura, Fujitsu                 | Sridhar Sudarsan, Sparkcognition   |
| Paul Gosling, Thales                         | Ruth Taylor, Maritime and Coastguard Agency                                  |
| Nadine Hachach-Haram, Proximie               |  |
| Rhianne Jones, BBC                           |  |

## Role

This group of Industrial Partners, drawn from key sectors, reviews the performance of the Hub and advises on priority areas. The TAS SAN offers access to testbeds, networks, and other resources. It also provides advise on an ad hoc basis.

# International Scientific Committee

## Chair



**Professor Gina Neff**

University of Oxford

## Members

- Alessandro Armando, University of Genova  
Barry Brown, DVU, Stockholm  
Bidisha Chaudhuri, IIIT Bangalore  
Alessandro Cimatti, FBK, Italy  
Wendy Ju, Cornell University  
Maurice Pagnucco, UNSW, Australia  
Beth Plale, Indiana University  
Carles Sierra, AI Research Centre, Barcelona
- Srinath Srinivasa, IIIT Bangalore  
Pradeep Varakantham, SMU, Singapore  
Ben Wagner, TU Delft

## Role

The International Scientific Committee reviews the TAS Programme’s research and impact against our objectives. This outcome of this review and the advice provided will be shared with the Nodes.



# Management Team



## Professor Sarvapali D. (Gopal) Ramchurn

UKRI TAS Hub Director

Director@tas.ac.uk

Professor Gopal Ramchurn holds a Chair of Artificial Intelligence at the University of Southampton and is a world-leader in Responsible AI. He is an advisor to international research councils, and an invited speaker to many industrial and public AI events where he advocates human-centred AI. He is a Turing Fellow and was a Co-Investigator on the award-winning ORCHID Programme grant where he successfully managed a cross-institutional/ disciplinary team, delivering multiple best paper awards at the top AI venues and tech transfer (including his own start-up).



## Dr. Kate Devlin

Dr. Kate Devlin is a Senior Lecturer in Social and Cultural Artificial Intelligence, King's College London. Coming from an Arts and Humanities background (as an archaeologist). Her work investigates how people interact with and react to technology, to understand how emerging and future technologies will affect us and the society in which we live.

Her recent research has focused on cognition, sexuality and intimacy and how these might be incorporated into cognitive systems. This formed the topic of her new book, Turned On: Science, Sex and Robots (Bloomsbury, 2018). Kate is a campaigner for gender equality and is involved in initiatives to improve opportunities for women in tech. She is also a mental health campaigner and fundraiser.



## Dr Joel Fischer

UKRI TAS Hub Research Director

Dr Joel Fischer is Associate Professor in Human-Computer Interaction at the University of Nottingham. He has been site Principal Investigator/Co-Investigator on 5 EPSRC projects.



## Professor Dame Wendy Hall

UKRI TAS Hub Skills Director

Professor Dame Wendy Hall is the UK Government's AI Skills Champion and author of the UK AI Growth Review. She is also Regius Professor of Computer Science, Executive Director of the Web Science Institute, a member of the UK AI Council and Pro Vice Chancellor International Engagement.

Professor Dame Wendy Hall co-chairs the UKRI TAS Hub's Skills Committee.



## Professor Derek McAuley

UKRI TAS Hub Deputy Director

Professor Derek McAuley holds a Chair of Digital Economy at the University of Nottingham. He brings to the UKRI TAS Hub his experience of successfully running the Horizon DER hub for ten years, as a founding director of the Cambridge Microsoft Research lab and his time as Chief Innovation Officer for the Digital Catapult.



## Professor Luc Moreau

UKRI TAS Hub Deputy Director

Professor Luc Moreau holds a Chair of Computer Science at King's College London, where he is also Head of the Department of Informatics. He was also Co-Chair of the standardisation group for Provenance at the World Wide Web Consortium.



## Dr Elvira Perez

UKRI TAS Hub Responsible Research, and Innovation (RRI) Director

Dr Elvira Perez is Associate Professor of Mental Health and Technology at the University of Nottingham. She is a Co-Investigator on eNurture Network+, HDI Network+ and ReEnTrust.



## Professor Sarah Sharples

UKRI TAS Hub Equality, Diversity, and Inclusion (EDI) Director

Professor Sarah Sharples holds a Chair of Human Factors and is Pro Vice Chancellor for EDI at the University of Nottingham. She is also Horizon CDT (Centre for Doctoral Training) Co-Director, Transport Systems Catapult Director and EPSRC Network+ Connected Everything II PI. Since July 2021, Sarah is the Chief Scientific Adviser to the Department for Transport.

# Research and Engagement Committee

## Chairs



**Dr Joel Fischer**

UKRI TAS Hub Research Director



**Dr. Kate Devlin**

UKRI TAS Hub Advocacy and Engagement Director

## Members

Dr Age Chapman  
Professor Susan Gourvenec ( Advocacy and Engagement Director until 09/21)  
Professor Mark Kleinmann, UKRI TAS Hub Policy Lead  
Professor Pauline Leonard  
Dr Justyna Lisinska  
Professor Paul Luff  
Dr David Maffin, Projects Manager  
Lou Male, Transformation Manager  
Professor Derek McAuley, UKRI TAS Hub Deputy Director  
Professor Luc Moreau, UKRI TAS Hub Deputy Director  
Professor Sarvapali Ramchurn, UKRI TAS Hub Director  
Professor Crawford Spence  
Dr Mercedes Torres Torres  
Professor Luca Viganò  
Angela Westley, Head of Operations

## Role

The Research and Engagement Committee acts as a structured round table overseeing the TAS Hub research programmes and shaping the Hub's interactions with a range of stakeholders.

It defines processes and provides coherent management of the agile, pump priming, integrator, and grand challenge programmes. It also establishes pathways for working with partners and other stakeholders, via oversight of the advocacy and engagement strategy, to help share best practices and encourage collaboration.

# Node Liaison Committee

## Chair



**Professor Luc Moreau**

UKRI TAS Hub Deputy Director

## Members

### Functionality

Dr Yansha Deng  
Professor James Scanlan

### Governance and regulation

Professor Tanya Aplin  
Dr Hana Chockler  
Dr Kate Devlin  
Dr Richard Hyde

### Resilience

Professor Michael Butler  
Dr Katie Plant

### Security

Professor Derek McAuley  
Dr Jose Such  
Professor Luca Viganò

### Trust

Dr Rita Borgo  
Professor Gary Burnett  
Dr Christine Evers  
Dr Elvira Perez

### Verifiability

Dr Son Hoang

### Hub

Dr Helen Shaw, Operations Team  
Angela Westley, Head of Operations

## Role

The Node Liaison Committee (NLC) is establishing working academic relationships with each node, to encourage the development of world-leading best practices for the design, regulation and operation of autonomous systems that are socially beneficial. The NLC will issue recommendations to the Executive Management Team to help shape the programme of research and engagement activities.



# Sector Leads Committee

## Chair



**Professor Derek McAuley**

UKRI TAS Hub Deputy Director  
(and IoT (Internet of Things) Sector Lead)

## Members

### Autonomous Vehicles

Dr Gary Burnett  
Professor James Scanlan

### Autonomous Systems

Professor Paul Luff

### Creative Industries

Dr Alan Chamberlain  
Professor Larry Lynch

### Defence and Security

Dr Alec Banks  
Dr Joseph Devanny  
Dr Christine Evers  
Dr Stuart Middleton

### Financial Services

Professor Crawford Spence  
Professor Carmine Ventre

## Role

The Sector Leads Committee aims to establish and shape partnerships across the TAS Programme. While initially focusing on the core sectors identified by the Hub, the SLC will seek to grow representation across other key sectors of interest. The SLC aims to ensure alignment to the needs of Industry, regulators, and other key stakeholders, including the wider public.

# Skills Committee

## Chairs



**Professor Dame Wendy Hall**

UKRI TAS Hub Skills  
Director



**Professor Steve Meers**

Head of AI  
Lab - Dstl

## Members

Dr Siddhartha Khastgir, Industrial Partnership lead

### Doctoral Training Network

Dr Christine Evers  
Daniel Heaton  
Professor Steve Benford, Horizon Centre for  
Doctoral Training (CDT) Director  
Professor Michael Luck, Safe and Trusted AI  
CDT Director  
Professor Tim Norman, MINDS (Machine  
Intelligence for Nano-electronic Devices and  
Systems) CDT Director

## Role

The Skills Committee aims to establish and encourage the development of best practices and training in trustworthy autonomous systems for postgraduate students and researchers. It is overseeing the development of a syllabus lab, with input from key industrial partners, and working with the wider community to provide entrepreneurship training, enabling students and research staff to develop routes to commercialisation.

### Syllabus Lab

Dr Caitlin Bentley  
Dr Horia Maior  
Professor Steve Meers  
Ben Pritchard

### Hub

Professor Derek McAuley  
Professor Luc Moreau  
Dr Elvira Perez  
Professor Sarvapali Ramchurn  
Ms Alison Tebbutt  
Professor Carmine Ventre

# Operations Team



## Angela Westley

Head of Operations, Southampton

Angela ensures the effective running of the Hub's operations on a day-to-day basis. She supports the EMT, TAS Board and Programme Co-ordination Group.

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## Dr Ben Coomber

Administrator, Nottingham

David is responsible for the Hub's Research Programme operations, planning and monitoring deliverables and milestones to generate business intelligence for the EMT. He also supports the Research and Engagement Committee and International Scientific Committee.

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## Dr David Maffin

Projects Manager, Southampton

David is responsible for the Hub's Research Programme operations, planning and monitoring deliverables and milestones to generate business intelligence for the EMT. He also supports the Research and Engagement Committee and International Scientific Committee.

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## Louise Male

Transformation Manager, Southampton

Contact@tas.ac.uk

Lou coordinates an ambitious programme of events, oversees the Hub's marketing strategy, and develops partner relations communications. She also supports the Sector Leads Committee.

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## Dr Helen Shaw

Administrator, King's College London

Helen supports the Deputy Director based at King's and co-ordinates Hub events and engagement activities.



## Alison Tebbutt

Skills Manager, Southampton

Alison supports the Skills Committee, Syllabus Lab and coordinates our skills programme of internships, placements, hackathons and liaises with partner CDT directors to manage the TAS Doctoral Training Network.



# Research Team

## Professor Wendy Adams

**Co-Investigator**  
University of Southampton

**Areas of Expertise**  
Psychology; Multisensory Perception;  
Computational Modelling

## Dr Tayyaba Azim

**Research Fellow**  
University of Southampton

**TAS Research**  
Areas of Expertise

**TAS Research**  
Deep learning, topic models, kernel  
methods, and real time systems.

## Professor Steve Benford

**Co-Investigator**  
University of Nottingham

**TAS Research**  
Creative Programme co-lead;  
TAS to support healthcare

**Areas of Expertise**  
Augmented and Mixed Reality; Mobile  
and Ubiquitous Computing; User  
Experience Design; Human-Computer  
Interaction

## Adrian Bodenmann

**Senior Research Assistant**  
University of Southampton

**TAS Research**  
Trustworthy human-swarm  
partnerships in extreme environment

**Areas of Expertise**  
3D visual mapping

## Professor Tanya Aplin

**Co-Investigator**  
King's College London

**Areas of Expertise**  
Copyright Law; Patent Law; Law of  
Confidential Information; Privacy Law

## Dr Alec Banks

**Principal Scientist**  
Dstl

**Areas of Expertise**  
Software systems and dependability.

## Dr Caitlin Bentley

**Assistant Professor**  
University of Sheffield

**Areas of Expertise**  
How AI-enabled cyber-physical systems  
can be safely, ethically, and sustainably  
scaled.

## Dr Rita Borgo

**Co-Investigator**  
King's College London

**Areas of Expertise**  
Data Science; Data Visualisation; Visual  
Analytics; Human Actors in Visualisation;  
Urban Informatics; High Performance  
Computing

## Dr David Bossens

**Research Fellow**  
University of Southampton

**Areas of Expertise**  
Multi-agent systems, recurrent neural  
networks, and reinforcement learning.

## Dr Alan Chamberlain

**Senior Research Fellow**  
University of Nottingham

**TAS Research**  
Creative Programme Co-Lead

**Areas of Expertise**  
Human Computer Interaction,  
Ethnography, Digital Arts/Humanities,  
Participatory Design, Community and  
Computing, and User Engagement.

## Dr Hana Chockler

**Co-Investigator**  
King's College London

**Areas of Expertise**  
Formal Verification of Hardware;  
Formal Verification of Software;  
Causality; Coverage and Vacuity;  
Explanation of Counterexamples;  
Software Testing.

## Dr Jeremie Clos

**Research Fellow**  
University of Nottingham

**TAS Research**  
SafespacesNLP

**Areas of Expertise**  
Applied interdisciplinary  
research involving machine  
learning at its core.

## Professor Prokar Dasgupta

**Co-Investigator**  
King's College London

**TAS Research**  
Trustworthy Human-Robot Teams

**Areas of Expertise**  
Robotic Surgery; Surgical Simulation.

## Dr David Branson III

**Associate Professor**  
University of Nottingham

**Areas of Expertise**  
Dynamics, Controls, Non-linear systems, Multibody  
systems, Wearable sensor systems, Collaborative  
Robotics, Soft robotics.

## Professor Adriane (Age) Chapman

**Co-Investigator**  
University of Southampton

**Areas of Expertise**  
Database Systems; Provenance; Data  
Retrieval; Algorithmic Accountability;  
Artificial Intelligence; Data Science; Data  
Economy.

## Dr Jediah Clark

**Research Fellow**  
University of Southampton

**TAS Research**  
Chatty Car

**Areas of Expertise**  
Human-machine cooperation  
and interface design.

## Dr Rita Borgo

**Associate Professor**  
University of Nottingham

**TAS Research**  
TAS for healthcare

**Areas of Expertise**  
Human factors aspects of virtual reality  
and interactive systems.

## Professor Roshan Das Nair

**Co-Investigator**  
University of Nottingham

**TAS Research**  
TAS for healthcare

**Areas of Expertise**  
Clinical psychology.

# Research Team

## Dr Yensha Deng

**Assistant Professor**  
King's College London

**Areas of Expertise**  
Molecular Communication.

## Dr Kate Devlin

**Co-Investigator**  
King's College London

**Areas of Expertise**  
Bias in Artificial Intelligence;  
Human-Computer & Human-Robot Interaction; Interaction Design in Emerging Technologies; Digital Cultural Heritage

## Professor Diana Eccles

**Co-Investigator**  
University of Southampton

**Areas of Expertise**  
Genetics; Cancer; Risk Prediction; Medicine; Clinical

## Dr Christine Evers

**Co-Investigator**  
University of Southampton

**TAS Research**  
Trustworthy Human-Robot Teams

**Areas of Expertise**  
Doctoral Training; Signal Processing; Audio and Acoustic; Machine Listening; Autonomous Agents

## Dr Joseph Devanny

**Assistant Professor**  
King's College London

**Areas of Expertise**  
Conflict and security

## Dr Elizabeth Dowthwaite

**Research Fellow**  
University of Nottingham

**TAS Research**  
Inclusive autonomous vehicles; TAS to support healthcare.

**Areas of Expertise**  
Social psychology and behavioural science.

## Dr Christian Enemark

**Co-Investigator**  
University of Southampton

**Areas of Expertise**  
Global Health Politics; International Security; Arms Control; Military Technologies; Drones; AI; Military Robots.

## Dr Joel Fischer

**Co-Investigator**  
University of Nottingham

**TAS Research**  
Chatty Car; Trustworthy Human-Robot Teams; Trustworthy human-swarm partnerships in extreme environment

**Areas of Expertise**  
Artificial Intelligence; Human-Centred AI; Voice-Speech Interaction; Ubiquitous Computing; IoT; Collocated Interaction

## Dr Maria Galvez Trigo

**Research Fellow**  
University of Nottingham

**TAS Research**  
Chatty Car; Trustworthy Human-Robot Teams; Trustworthy human-swarm partnerships in extreme environment

**Areas of Expertise**  
Robotics; machine learning; human computer interaction; human robot interaction.

## Dr Murray Goulden

**Co-Investigator**  
University of Nottingham

**Areas of Expertise**  
Internet of Things; Smart Home; Governance and Design; Energy; Digital Data

## Professor Dame Wendy Hall

**Co-Investigator**  
University of Southampton

**Areas of Expertise**  
Skills Champion for AI; Web Science; Digital Economy

## Dr Son Hoang

**Assistant Professor**  
University of Southampton

**Areas of Expertise**  
Formal System Development, including developing methods, tools, and their application to industrial systems.

## Professor Richard Hyde

**Co-Investigator**  
University of Nottingham

**TAS Research**  
Trustworthy Human-Robot Teams

**Areas of Expertise**  
Law; Regulation; Governance; Public Engagement; Food Safety; Food Law.

## Dr Richard Gomer

**Research Fellow**  
University of Southampton

**Areas of Expertise**  
Human-Computer Interaction (HCI) research, with a particular interest in how individuals and groups interact with large-scale systems, how those systems are designed, and how things like values and agency play out within them.

## Professor Susan Gourvenec

**Co-Investigator**  
University of Southampton

**Areas of Expertise**  
Intelligent and Resilient Ocean Engineering; Ocean Structures; Geotechnical Engineering; Energy

## Dan Heaton

**Postgraduate researcher**  
University of Nottingham

**Areas of Expertise**  
Natural Language Processing and Multi-Modal Sentiment Analysis.

## Dr Ann Marie Hughes

**Co-Investigator**  
University of Nottingham

**Areas of Expertise**  
Rehabilitation; Neurological Conditions; Non-Invasive Brain Stimulation; Wearable Robotics; Telerehabilitation; Movement Sensors

## Dr Nils Jaeger

**Assistant Professor**  
University of Nottingham

**TAS Research**  
TAS for healthcare

**Areas of Expertise**  
Human-building interaction, (digitally) adaptive architecture, personal data, wellbeing, and theories of embodiment.



# Research Team

## Dr Siddartha Khastgir

**Industrial Fellowship Lead**  
University of Warwick

**Areas of Expertise**  
Connected and Autonomous Vehicles (CAVs) Verification & Validation; Safety, Test Scenarios, Simulation, Safe AI, real-world testing, Systems Engineering, Trust in Automation, Standardisation.

## Dr Alexandra Lang

**Assistant Professor**  
University of Nottingham

**TAS Research**  
TAS for healthcare

**Areas of Expertise**  
Application of human factors to healthcare.

## Dr Anita Lavorgna

**Associate Professor**  
University of Southampton

**TAS Research**  
SafespacesNLP

**Areas of Expertise**  
Cyber harms and cybercrimes, information pollution and its propagation online, ethics and sociotechnical approaches in online research.

## Dr Justyna Lisinska

**Research Fellow**  
King's College London

**TAS Research**  
Policy

**Areas of Expertise**  
Populism on social media.

## Dr Ayse Kucukyilimaz

**Assistant Professor**  
University of Nottingham

**TAS Research**  
Human-robot teams

**Areas of Expertise**  
Haptics, physical human-robot interaction, assistive robotics, and machine learning.

## Dr David R. Large

**Senior Research Fellow**  
University of Nottingham

**TAS Research**  
Chatty Car

**Areas of Expertise**  
Design, evaluation, and acceptance of novel and emerging in-vehicle human-machine interfaces (HMIs) and systems for both road and rail transport.

## Professor Pauline Leonard

**Assistant Professor**  
University of Southampton

**TAS Research**  
Human-robot teams

**Areas of Expertise**  
Diversity and the changing nature of work.

## Professor Paul Luff

**Co-Investigator**  
King's College London

**TAS Research**  
Trustworthy Human-Robot Teams

**Areas of Expertise**  
Public Services Management and Organisation; Video Based Ethnography; Augmented Technologies; Robotics; Novel Video-Mediated Systems.

## Professor Larry Lynch

**Assistant Professor**  
University of Southampton

**Areas of Expertise**  
Creative technologies, Performance writing

## Dr Miguel Massot Campos

**Senior Research Fellow**  
University of Southampton

**TAS Research**  
Trustworthy human-swarm partnerships in extreme environment

**Areas of Expertise**  
Field robotics.

## Dr Steve Meers

**Head of AI lab**  
Dstl

**Areas of Expertise**  
Application of AI, machine learning and data science to defence and security challenges

## Professor Luc Moreau

**Co-Investigator**  
King's College London

**Areas of Expertise**  
Data Provenance; Distributed Systems; Service Orientated Architectures; Distributed Algorithms; Formal Proof of Algorithms

## Dr Elena Nichele

**Research Fellow**  
University of Nottingham

**TAS Research**  
Chatty Car; SafespacesNLP.

**Areas of Expertise**  
Applied linguistics

## Dr Katie Parnell

**Research Fellow**  
University of Southampton

**TAS Research**  
Chatty Car.

**Areas of Expertise**  
Ensuring human-machine systems are usable, efficient and safe.

## Dr Horia Maior

**Assistant Professor**  
University of Nottingham

**Areas of Expertise**  
Human-Computer Interaction (HCI), Brain Computer Interfaces (BCI) and Human factors

## Professor Derek McAuley

**Co-Investigator**  
University of Nottingham

**Areas of Expertise**  
Digital Economy; Behavioural Change; Energy Consumption; Ubiquitous Computing; Computer Architecture; Networking; Privacy; Information Policy; Digital Society.

## Dr Stuart Middleton

**Assistant Professor**  
University of Southampton

**Areas of Expertise**  
SafespacesNLP  
Natural language processing, computational linguistics, information extraction and machine learning.

## Dr Mohammad Naiseh

**Research Fellow**  
University of Southampton

**TAS Research**  
Inclusive autonomous vehicles.

**Areas of Expertise**  
Natural language processing; explainability and transparency of AI-based decision-making tools

## Ashley Pare

**Postgraduate researcher**  
University of Southampton

**TAS Research**  
Trustworthy human-swarm partnerships in extreme environment

## Dr Elvira Perez

**Co-Investigator**  
University of Nottingham

**Areas of Expertise**  
Digital Technology and Mental Health; Medicine; Digital Humanism; Cybersecurity; Digital Economy.

# Research Team

## Dr Katie Plant

**Co-Investigator**  
Co-Investigator

**TAS Research**  
Chatty Car

**Areas of Expertise**  
Human Factors Engineering; Cognitive Work Analysis; Hierarchal Task Analysis; Error Analyses and Critical Path Analysis.

## Dr Ben Pritchard

**Group Leader/ Industrial Fellow**  
Thales

**Areas of Expertise**  
Autonomous Systems

## Matthew Rawsthorne

**Postgraduate researcher**  
University of Nottingham

**Areas of Expertise**  
Mental health and well being

## Professor James Scanlan

**Co-Investigator**  
University of Southampton

**Areas of Expertise**  
Aerospace Design; Design Decision Support Systems; Aerospace Manufacturing; Process Optimisation; Discrete-Event Simulation; Aerospace Product Life-Cycle Analysis and Costing; UAVs; Drones.

## Professor Sarah Sharples

**Co-Investigator**  
University of Nottingham

**Areas of Expertise**  
Materials and Manufacturing Engineering; Doctoral Training; Cognitive Ergonomics; Human Factors; Equality; Diversity and Inclusion

## Dr Dominic Price

**Research Fellow**  
University of Nottingham

**TAS Research**  
Human-Robot Teams

**Areas of Expertise**  
Digital economy

## Professor Sarvapali Ramchurn

**Co-Investigator**  
University of Southampton

**TAS Research**  
Trustworthy human-swarm partnerships in extreme environment

**Areas of Expertise**  
Cyber-Physical Systems; Smart Energy Systems; Machine Learning; Ai; Game Theory; IoT.

## Dr Rita Samiolo

**Co-Investigator**  
King's College London

**Areas of Expertise**  
Accounting; Financial Management; Economic Calculation; Transnational Governance

## Dr Diego Sempreboni

**Research Fellow**  
King's College London

**Areas of Expertise**  
Security protocols involving human users

## Professor Paurav Shukla

**Co-Investigator**  
University of Southampton

**TAS Research**  
Chatty Car; Inclusive autonomous vehicles.

**Areas of Expertise**  
Marketing; Digital Data; Consumption Practises; Consumer Behaviour; Identity Signalling; Status Consumption; Digital Economy.

## Dr Mohammad Divband Soorati

**Research Fellow**  
University of Southampton

**TAS Research**  
Trustworthy human-swarm partnerships in extreme environment

**Areas of Expertise**  
Swarm and evolutionary robotics..

## Professor Crawford Spence

**Co-Investigator**  
Kings College London

**Areas of Expertise**  
Accounting; Financial Management

## Dr Sylvaine Tuncer

**Research Fellow**  
King's College London

**TAS Research**  
Trustworthy Human-Robot Teams

**Areas of Expertise**  
Robot-assisted surgery and autonomous systems in the financial sector.

## Professor Luca Vigano

**Co-Investigator**  
King's College London

**Areas of Expertise**  
Formal Methods for Security; Security Logics; Security Testing; Labelled Deduction for Non-Classical Logics (Modal Logics; Substructural Logics; etc.); Combination of Logics.

## Dr Nicholas Watson

**Associate Professor**  
University of Nottingham

**TAS Research**  
Human-Robot Teams

**Areas of Expertise**  
Chemical engineering

## Dr Alexa Spence

**Co-Investigator**  
University of Nottingham

**Areas of Expertise**  
Social Psychology; Economic Psychology; Environmental Psychology; Climate Change; Energy Issues; Public Perceptions.

## Dr Mercedes Torres Torres

**Co-Investigator**  
University of Nottingham

**TAS Research**  
Trustworthy Human-Robot Teams

**Areas of Expertise**  
Medicine; Newborns; Neonatal; Pain Analysis; Clinical

## Professor Carmine Ventre

**Co-Investigator**  
King's College London

**Areas of Expertise**  
Algorithmic Game Theory; Microeconomics and The Internet; Algorithms and Complexity; (Ai for) Algorithmic Trading and Finance; Cryptography and Security

## Dr Christian Wagner

**Co-Investigator**  
University of Nottingham

**Areas of Expertise**  
Cyber Security; Human Data; Decision Making.

## Dr Sanchini Weerawardhana

**Research Fellow**  
King's College London

**Areas of Expertise**  
Human-aware automated planning, intervention planning, human-agent interactions, and explainable planning systems.



# TAS Nodes

## Functionality



**Dr Shane Windsor**  
Principal Investigator Functionality Node

**Key research questions:**

- **Evolving functionality:** how adaptation needs to be specified, designed, verified, validated, curated, and regulated to ensure it is safe, reliable, resilient, ethical, and trustworthy.
- Innovative techniques to address the identified requirements, creating a **Design-for-Trustworthiness** framework.
- Develop state-of-the-art trustworthy autonomous technologies with evolving functionality.
- Create **best-practice guidance** for specifying, designing, verifying, validating, curating, and regulating autonomous systems with evolving functionality.



## Governance and regulation



**Professor Subramanian Ramamoorthy**  
Principal Investigator Governance and regulation Node

**Key research questions:**

- **New frameworks** that help bridge gaps between legal and ethical **principles and the design** process around AI-enabled autonomous systems
- **New tools** for an ecosystem of regulators, developers and trusted third parties:
  - Functionality beyond technical correctness
  - How/why systems fail, technically and socio-technically
  - How one should manage associated evidence to facilitate better governance.
- Evidence from **full-cycle case studies** of taking AS through regulatory processes, as experienced by our partners, to facilitate policy discussion regarding new forms of reflexive regulation.



## Resilience



**Dr Radu Calinescu**  
Principal Investigator Resilience Node

**Key research questions:**

- **Focus on Social, Legal, Ethical, Empathy & Cultural (SLEEC) rules and norms**
- How can TAS **reason about feasible** & SLEEC-compliant decisions and **actions supporting resilience**?
- How can TAS reason about **reducing uncertainty**, and about **prediction and detection of disruptions**?
- How can TAS reason about knowledge and service sharing with humans and peer autonomous systems?
- How can TAS reason about **dynamic assurance of decisions & actions supporting resilience**?



## Security



**Professor Neeraj Suri**  
Principal Investigator Security Node

**Key research questions:**

- **AS Usage:** Establish the fundamental framework for providing and assessing multi-layered, **multi- dimensional adaptive AS security** in dynamic mixed mode environments (MME).
- **AS Operations:** Ascertain exposure (and their consequent mitigation) of AS “Operations” to cyber-physical attacks by characterizing the **attack surfaces** (i.e., entry points and likelihoods) across the mission, control and information surfaces in a technology and mission-invariant manner.
- **AS User:** Develop novel **socio-technical, legal, and regulatory approaches** to ascertain and mitigate AS threats to provide a secure AS “User” environment.



# TAS Nodes

## Trust



**Professor Helen Hastie**  
Principal Investigator Trust Node

**Key research questions:**

- Can we create a **cognitive architecture for trust** that models a variety of trust factors including Theory of Mind?
- Can we define a set of **principles of how trust is acquired** over time, adapted to context, errors, the environment and the user; and create adaptive systems including principles for transparent interaction?
- Can we create an **evaluation framework** for reliably measuring trust in a non-intrusive manner, applicable across multiple domains?



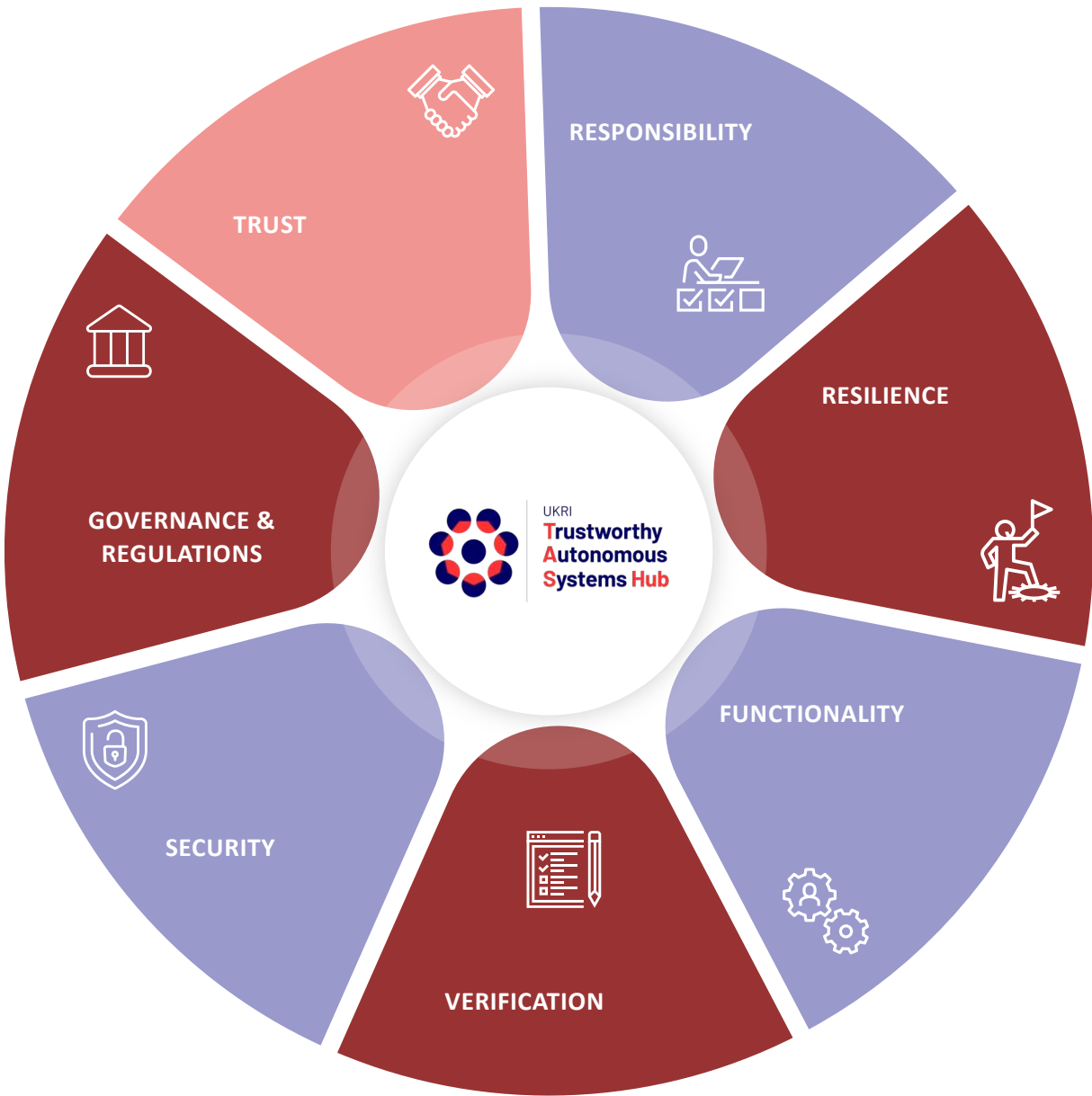
## Verifiability



**Professor Mohammad Mousavi**  
Principal Investigator Verifiability Node

**Key research questions:**

- Verifiability concepts, notations, and techniques for Autonomous Systems
- **Taxonomy of Verified Autonomy**
- Compose and translate verification models
- Variability and uncertainty in CPS
- Robust sub-symbolic and symbolic AI
- Verification of user behaviour





# Research Programmes

## AP

The Agile Programme, comprises short, focussed multidisciplinary projects (3-12 months) involving at least two of the core (Hub/Node) TAS Programme Universities.

## IP

The Integrator Programme drives cross-cutting activities that will synthesise and consolidate the strands of the overall TAS Programme into coherent research activities e.g., Responsible Research and Innovation (RRI) Framework for TAS.

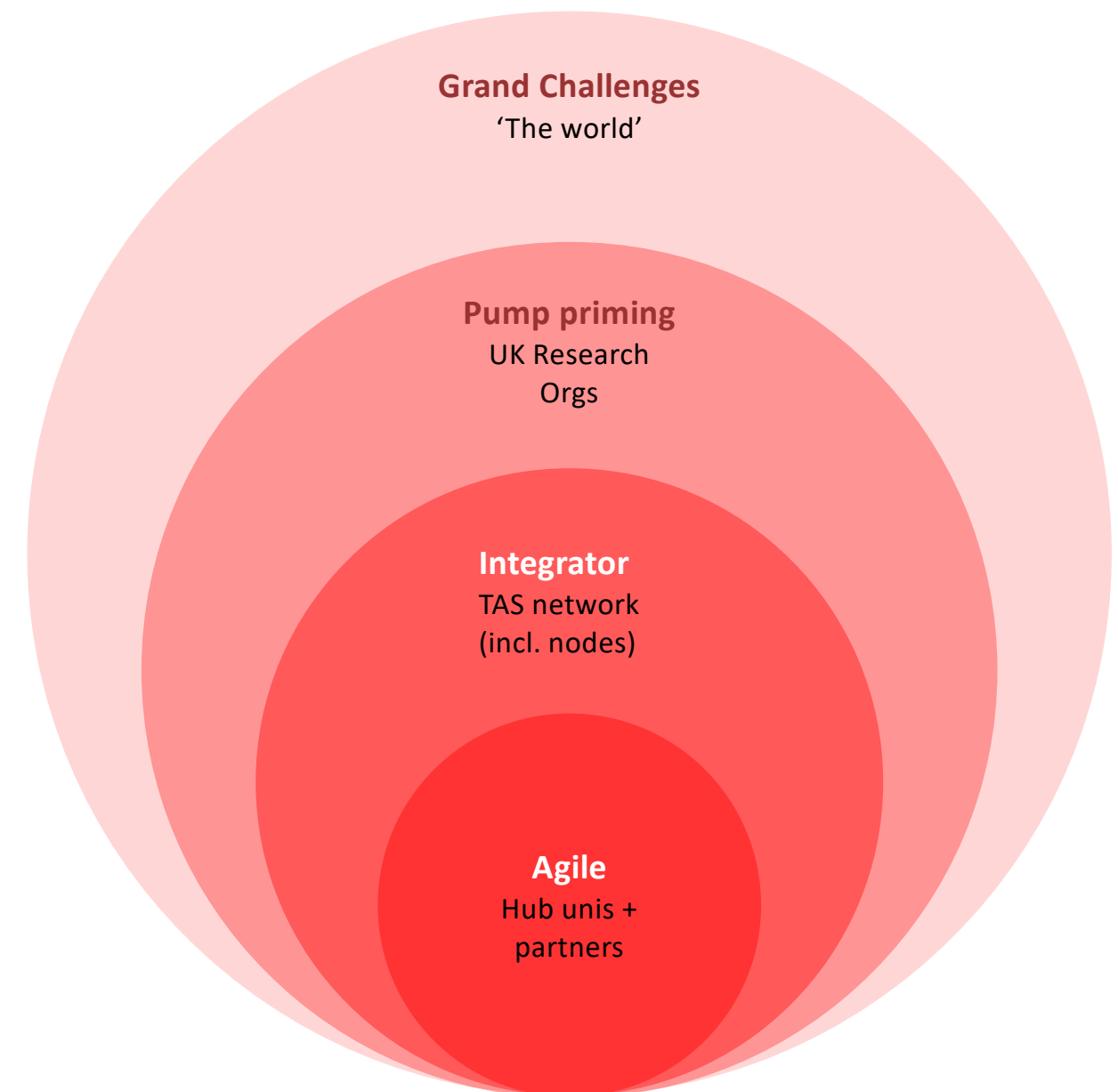
## PP

The Pump Priming Programme will provide up to £5M of competitive research funding to the UK research community at large with targeted open calls to fund complementary and integrative research. A variety of project types, from early career proof of concept or foundational research through to exchanges and business incubation are eligible.

## GCP

The Grand Challenges Programme will source grand challenges for the TAS Programme from the international TAS community (similar to EPSRC Big Ideas). These ideas will go through a sifting and consultation process. Selected ideas may be developed further via specific pump priming calls for example and may lead to further funding calls from UKRI.

The TAS Hub Research programmes, Agile, Integrator, Pump priming and Grand Challenges complement and integrate the nodes' research.



# Current research projects

This year we have invested £1.4M in 12 new pump priming projects, in addition to 6 agile projects, across a range of domains, including autonomous vehicles, defence and security, health and care, and AI ethics and governance.

Agile projects are short, focused multidisciplinary projects, co-created with partners, and aiming to complement research undertaken by the Nodes. We launched our first Agile call in September. Ideas were sought from the TAS Hub community and developed further at a sandpit and subsequent sprint proposal creation. We received a number of strong, multidisciplinary proposals and are delighted to announce the funding of six, which commenced in February 2021.

In our first pump priming call, we sought projects that broadly address the Hub Grand Challenges. The call was open to all researchers in UK institutions, enabling inclusion of new partners to bring additional value to the Programme. Applicants were however required to demonstrate a strong link to the Hub or a Node to ensure integration with the wider TAS programme. The majority of these projects commenced in April 2021.

In total, 78 bids were submitted, with 12 projects selected to receive funding. Of these funded projects, which all include Early Career Researchers, 33% are categorised as early-stage proof of concept, 50% foundational research, 8% industry driven application research and 8% as advocacy and engagement projects. 47% of bids aligned with one or more nodes, and there is at least one funded project aligned with each of the six Nodes. Whilst the key sector representation was skewed towards the autonomous vehicles and healthcare sectors, 53% of bids and 67% of funded projects aligned with TAS' key sectors.

This initial portfolio of multi-disciplinary projects has already created new connections, both between the project teams and across the wider TAS community.



# Current research projects

## Autonomous vehicles

### Chatty Car



**Gary Burnett**

Automated vehicles (AVs) promise to enhance driver comfort and wellbeing, and ultimately, deliver ‘mobility for all.’ Near-future AVs will create a new, driver-vehicle symbiosis in which both human and non-human agents must work together in pursuit of a common goal. Understanding this relationship and ensuring the appropriate allocation of trust is therefore paramount, particularly during the transfer of control. The project aims to use existing datasets supported by relevant theory and apply multi-disciplinary methods to design an exemplar, socially responsible, anthropomorphised, natural language interface, encompassing both lexical and non-lexical mediators of trust, and curating findings in a preliminary design framework.

**LEAD CONTACT:** Gary Burnett, Professor of Transport Human Factors, University of Nottingham

### Inclusive autonomous vehicles: the role of human risks perception and trust narratives



**Paurav Shukla**

With AI for autonomous vehicles evolving from limited responsibility to fully autonomous driving, this project posits that each level of AI control handover triggers different levels of risk perceptions and trust concerns as it involves varying levels of consumer commitment and relinquishing of control. Grounded in the theories of social psychology and behavioural economics, this project will uncover how concerns with AI can be alleviated at each level. In so doing, we will investigate the mechanisms that can address consumers’ concerns and increase their overall trust and well-being. The project will help in managing evolution for inclusive human-AI interactions.

**LEAD CONTACT:** Paurav Shukla, Professor of Marketing and Head of Digital and Data Driven Management Department, University of Southampton

### SafeSpaces NLP: Behaviour classification NLP in a socio-technical AI setting for online harmful behaviours for children and young people



**Stuart Middleton**

We will explore the use of Socio-Technical Natural Language Processing (NLP) for classifying behavioural online harms within online forum posts (e.g. bullying; drugs & alcohol abuse; gendered harassment; self-harm), especially for young people. Our socio-technical AI will explore both zero-shot and graph-based NLP algorithms for behaviour classification, using a cyclic socio-technical methodology. This approach will facilitate incremental use of human feedback for iterative learning and re-ranking, overcoming the limited training data issue and keeping a ‘human in the loop.’ We follow an inclusive multi-disciplinary research approach, integrating stakeholders into our experiments from the start.

**LEAD CONTACT:** Stuart Middleton, Lecturer in Computer Science, University of Southampton

## Health and care

### SA<sup>2</sup>VE: Situational Awareness and trust during Shift between Autonomy levels in automated Vehicles



**Bani Anvari**

In the race towards the first commercially available fully Autonomous Vehicles (AVs), the number of AVs on roads will dramatically increase. Humans are challenged to change between autonomy levels causing safety concerns. SA<sup>2</sup>VE sets out to understand the effect of Situational Awareness and take-over request procedures on trust between drivers and AVs. Physiological/behavioural data and self-reporting Situational Awareness and trust ratings will be analysed in driving scenarios based on real-world incidents involving AVs. For a successful rollout of fully AVs, it is of paramount importance to address safety gaps in AVs until fully automated driving becomes feasible.

**LEAD CONTACT:** Bani Anvari, Assistant Professor in Intelligent Mobility, Director of Intelligent Mobility Lab, University College London



# Current research projects

## Trustworthy Human-Robot Teams



**Nicholas Watson**

The COVID19 pandemic has presented novel challenges for routine tasks such as surgery and cleaning. Social distancing makes working in close proximity difficult, exacerbated by additional pressures due to employee sickness and austerity measures. These challenges present increased opportunities for human-robot collaborative teams but questions remain relating to trust towards the robot within the team and more broadly, the trust of affected groups (e.g., patients) towards tasks carried out by robot-assisted teams. This interdisciplinary TAS Hub agile project will explore different aspects related to trust within and towards human-robot teams in two essential tasks: surgery and cleaning.

**LEAD CONTACT: Nicholas Watson**, Associate Professor, University of Nottingham

## Trustworthy autonomous systems to support healthcare experiences



**Liz Dowthwaite**

This project explores how trustworthy autonomous systems embedded in devices in the home can support decision-making about health and wellbeing. Exploring monitoring of the general health and wellbeing of non-clinical users in the home (including vulnerable groups), TAS for Health aims to integrate understandings of attitudes towards the use of AI in healthcare decision-making in the home across the potential spectrum of use, including patients, carers, and other service users. In particular, the project will look at how decision-making relates to shared values, such as trust, self-efficacy, privacy, and so on.

**LEAD CONTACT: Liz Dowthwaite**, Professor of Human Robot Interaction, University of Hertfordshire

## COdesigning Trustworthy Autonomous Diabetes Systems (COTADS)



**Michael Boniface**

COTADS will explore how to increase trust of AI used for diabetes management inside and outside clinical settings during life transitions. AI is expected to provide a crucial role in the management of chronic conditions, yet technology-driven solutions are unlikely to be adopted. AI design must consider the complex medical, lifestyle and socio-technical needs at times of uncertainty and life transitions. COTADS will bring together people with diabetes, clinicians, and data scientists in a novel co-design process for diabetes risk stratification. Using co-design, provenance, and explainable AI, we aim to ensure solutions are understandable, transparent, trustworthy, and beneficial.

**LEAD CONTACT: Michael Boniface**, Professorial Fellow of Information Systems, Director of the IT Innovation Centre, University of Southampton

## Imagining Robotic Care: Identifying conflict and confluence in stakeholder imaginaries of autonomous care systems



**David Cameron**

Although autonomous systems are considered vital in addressing health-social care needs, research into stakeholder expectations is sparse. Identifying misalignment of expectations early can enhance research programmes, improve prototyping, and embed responsible innovation practices before projects start. We use LEGO Serious Play as a method for collecting data on socio-technical “imaginaries” (collectively achieved, systemic visions of social transformation through technology) of autonomous care held by diverse stakeholders across the health-social care ecosystem, including roboticists, administrators, carers, and care users. By examining where imaginaries cohere and conflict, we can support TAS researchers to design resilient systems aimed at filling urgent needs.

**LEAD CONTACT: David Cameron**, Lecturer in Human-Computer Interaction, University of Sheffield

# Current research projects

## Trustworthy light-based robotic devices for autonomous wound healing



**Sabine Hauert**

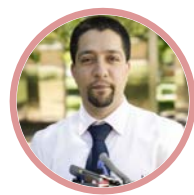
Each year approximately 2.2 million UK adults are inflicted with a wound.

Robotic technologies have the potential to guide wound healing at the cellular level. Machine learning allows us to tailor the control to individual cellular dynamics on the go, enabling personalised solutions. This raises questions about how to ensure these systems are trustworthy and safe.

Our recent work presents a new device for the autonomous control of cellular systems using light. In this project we will 1) demonstrate wound healing in the laboratory, and 2) define an envelope of operation that balances risks and benefits of machine learning and autonomous control.

**LEAD CONTACT: Sabine Hauert**, Associate Professor of Swarm Engineering Bristol Robotics Laboratory, University of Bristol

## Kaspar explains: the impact of explanation on human-robot trust using an educational platform



**Farshid Amirabdollahian**

Children with autism often struggle with the concept of causality particularly in the context of social interactions with others. Kaspar is a state-of-the-art humanoid robot that is primed for interaction with children with autism. The interaction often includes a teacher or wizard of Oz approach to progress educational goals. We hypothesise that giving Kaspar the ability to explain its interaction goals may provide a more trustworthy educational tool, for children, their parents, and their teachers. We evaluate this using two scenarios, one with causal explanations added, and one without, then explore trust and educational outcomes.

**LEAD CONTACT: Farshid Amirabdollahian**, Professor of Human Robot Interaction, University of Hertfordshire

## An Open Laboratories Programme for Trustworthy Autonomous Systems (OPEN-TAS)



**Tony Prescott**

Responsible research and innovation requires engaging openly with the wider public about research plans and activities in TAS. Engagement also has educational value, helping learners to understand about jobs and research opportunities and the skills and knowledge they require. This project will create infrastructure for access via web/VR interfaces and telepresence robots to UK laboratories researching TAS. Beginning with a seed group of universities, companies and NGOs, the project will run a pilot with 4 leading laboratories to create an engagement experience that is educational, scalable and meets social-distancing requirements due to Covid-19.

**LEAD CONTACT: Tony Prescott**, Professor of Cognitive Robotics, Director Sheffield Robotics, University of Sheffield

## Defence and security

### Trustworthy human-swarm partnerships in extreme environments



**Mohammad Divband Soorati**

The aim of this project is to understand the contextual factors and technical approaches underlying trustworthy human-swarm teams. The project will draw on co-creation with partners and potential users to generate potential use cases and operator-centred requirements. AI-based algorithms will be used to estimate the swarm state and recommend control actions to the human operators in extreme environments. We will evaluate the trustworthiness of our system in a user study with a proof-of-concept HAC simulation and testing platform. The vision is to make our approach broadly applicable in human-swarm use cases, within and beyond the TAS Programme.

**LEAD CONTACT: Mohammad Divband Soorati**. Alan Turing Research Fellow in Human-Machine teaming, University of Southampton

# Current research projects

## AI ethics and governance

### Consent verification in autonomous systems



**Inah Omoronyia**

A regulatory mechanism based on user consent is fundamental to govern how user information is collected and processed to preserve privacy and mitigate harm. However, assumptions underlying the verification of existing consent approaches make it hard to demonstrate compliance in autonomous systems. For instance, autonomous systems may rapidly evolve and mutate to circumvent consent granted by users' ex-ante. This project will investigate reasoning techniques that can support regulatory and certification stakeholders in verifying user consent in autonomous systems to ensure compliance. This research will also support autonomous applications developers, providing insights on regulatory compliance risk involving their design decisions.

**LEAD CONTACT:** Inah Omoronyia, Lecturer in Software Engineering & Information Security, University of Glasgow

## A participatory approach to the ethical assurance of digital mental healthcare



**Christopher Burr**

While there exist numerous tools to support the argument-based assurance (ABA) of the safety of complex technical systems, there has been little research into whether this same methodology could provide support for ethical goals, such as fairness or autonomy. This project will use a participatory methodology to develop such a novel approach to ABA, which can underwrite the responsible design, development, and deployment of autonomous and intelligent systems in mental healthcare. We will work with stakeholders to co-develop a methodology of ethical assurance, including corresponding argument patterns that help to build consensus and confidence that ethical issues have been properly considered throughout a project's lifecycle.

**LEAD CONTACT:** Christopher Burr, Ethics Fellow, Alan Turing Institute





# Current research projects

## RoAD—Responsible AV Data: Ethical, legal, and societal challenges of using data from autonomous vehicles



**Marina Jirokta**

Autonomous Systems (AS) may offer significant societal benefits but will also create new types of incidents and accidents. The ability to access, explain and understand data related to failure or accidents will be a fundamental requirement for ensuring safety, liability, and public trust. Drawing on Responsible Research and Innovation principles, we analyse a particular AS - Autonomous Vehicles (AVs) - with three objectives: 1) Investigate the ethical risks and legal implications related to the collection, access and use of data. 2) Test the legal usefulness of datasets. 3) Evaluate public acceptance of data recorders ('black boxes') for AS.

**LEAD CONTACT:** Marina Jirokta, Professor of Human Centred Computing, University of Oxford

## Understanding user trust after software malfunctions and cyber intrusions of digital displays: A use case of automated automotive systems



**William Payre**

This research investigates the cyber security, human factors, and trust aspects of screen failures during automated driving. Screen failures can be either silent (i.e., drivers are not informed) or explicit (i.e., drivers are warned). From the cyber perspective, we will be conducting a threat analysis, with our industrial stakeholders, of in-vehicle digital displays. This will lead to a series of use cases being developed when possible malfunction or intrusion (hacking) would occur. These use cases are replicated in our driving simulator where we will investigate participants' responses to aspects like trust in the automation, driving performance, safety, and biometrics.

**LEAD CONTACT:** William Payre, Assistant Professor in Transport Design & Human Factors, University of Coventry



# Current research projects



## AI-Assisted Resilience Governance Systems (ARGOS)

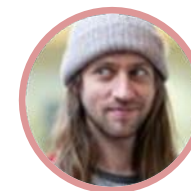


**Enrico Gerding**

Existing governance measures for ensuring resilience in society are struggling to deal with compound risks such as extreme climate change events during pandemics. We argue that resilience governance systems can benefit from technological advancements in the field of Artificial Intelligence (AI). AI has the capacity to support resilience governance to be geared towards anticipatory action as a means to increase resilience in society. This project aims to investigate the applicability of machine learning methods to support anticipatory planning for resilience, simulation-based AI techniques for policy appraisal in view of compound risks, and AI-based coordination mechanisms for resilience-aware policy enforcement.

**LEAD CONTACT:** Enrico Gerding, Associate Professor, Director of the Centre for Machine Intelligence (CMI), University of Southampton

## Trust Me? (I'm an Autonomous Machine)



**Joseph Lindley**

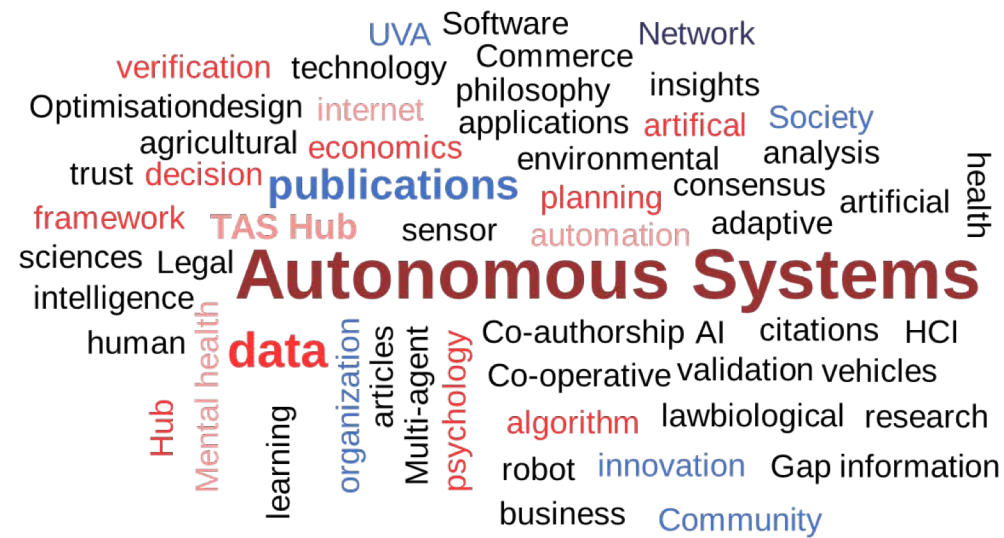
There exists a significant gap between expert and public understandings of autonomous systems, which may be consequential to their acceptability and adoption in everyday life. Mutually intelligible understandings of autonomous systems, what they seek to achieve, the risks associated with them, and how such risks might be mitigated are needed to shape the development of Trusted Autonomous Systems. We leverage an interdisciplinary design-led approach to enable foundational research engaging technical communities and the public alike in the elaboration of new socio-technical narratives that explore autonomy and trust and will drive the adoption of Trustworthy Autonomous Systems in society.

**LEAD CONTACT:** Joseph Lindley, Research Fellow, University of Lancaster



# Landscape mapping

The TAS Hub is working with Digital Science, a leading data analytics service provider, to carry out a comprehensive mapping exercise of trustworthy autonomous systems research.



## Digital Science's bibliometric analysis is helping the TAS Hub to understand



What research, in the last 10-15 years, has been done on the different elements of trustworthy autonomous systems across different disciplines?



What are the key ongoing research programmes that relate to TAS?



What gaps can be identified in terms of inter-disciplinary and fundamental research?



How should we prioritise research to fill the gaps and to strengthen the existing initiatives?



What international programmes align well with the TAS programme and how should the TAS Hub form partnerships with them?



What gaps in expertise exist in the UK?



The initial review of the TAS landscape indicates that between 2005 and 2019 the UK participated in 128,000 publications (9.1% of all global publications) in six identified subfields of TAS: Business marketing, verification validation, mental health, law, HCI and multi-agent systems. Publications in all subfields have increased from 51k in 2005 to 1.4M in 2019.



The results of this exercise will be disseminated widely and will help inform how the TAS Hub and Nodes engage a wider community of researchers and stakeholders.



## Skills programme

The Skills Programme includes a Doctoral Training Network (DTN), Syllabus Lab to develop new training materials and industrial internships and fellowships.

## Doctoral Training Network Seminars

Date	Title	Speaker	Institution
30/03/2021	Learn by doing: what does the introduction of AI to a non-AI, role expert team do and mean?	Shaun Lamb	University of Southampton
	Robotics and the Law: Towards responsible and sustainable human-robot collaboration in the case of digital manufacturing	Natalie Leesakul	University of Nottingham
	Preventing AI from destroying humanity (or how to ensure value-aligned behaviour in agents)	Jason Szabo	King's College London
15/04/2021	The Chatty Car	Professor Gary Burnett	University of Nottingham
26/04/2021	Autonomous Systems in Defence - Military Advantage through Trustworthiness	Dr Alec Banks	Dstl
10/05/2021	Human-Swam Interaction in Uncertain Environments	Dr Mohammad Divband Soorati	University of Southampton
26/05/2021	Human Centred AI and Autonomous Systems: are they compatible?	Professor Steve Meers and Professor Dame Wendy Hall	Dstl and University of Southampton
09/06/2021	SafeSpaces NLP - Behaviour classification NLP in a socio-technical AI setting for online harmful behaviour for children and young people	Dr Stuart Middleton	University of Southampton
27/07/2021	Policy issues for autonomous systems in healthcare, defence and autonomous vehicles	Professor Mark Kleinman, Dr Rachel Hesketh, Dr Justyna Lisinska and Julian Krause	King's College London and University of Southampton

# Doctoral training network (DTN)

A significant component of our vision is to develop the next generation of highly skilled TAS researchers, designers, and engineers. The TAS DTN has been established to connect transdisciplinary PhD researchers across the TAS Programme and is open to doctoral researchers from any UK institution undertaking autonomous systems research.

Launched in February 2021, we are pleased to report over 70 members, in June 2021, from 17 different institutions.

We aim to bring together a diverse group of doctoral researchers, from different disciplines, sectors, and backgrounds. The DTN will offer facilitated training and best practice, opportunities to share TAS-related research, and connect doctoral researchers with TAS projects, a diverse team of academic staff, and our industry partners. DTN activities will include seminars, training sessions, workshops, summer schools and student conferences. As part of a wider TAS Skills Programme, the TAS Hub will also engage with industry partners to promote Internship opportunities for DTN students, as well as Industrial Fellowships for staff.



# Syllabus lab

The Syllabus Lab is a collaborative project between academic institutions, industry partners and professional organisations to facilitate upskilling and reskilling within key industries. Its aims are:



To understand sector-specific requirements that are directly relevant to industry



To identify core topics and activities that reflect the multidisciplinary needs of current and future TAS engineers and researchers



To develop and promote research-led and industry-led TAS training resources.



# Outreach

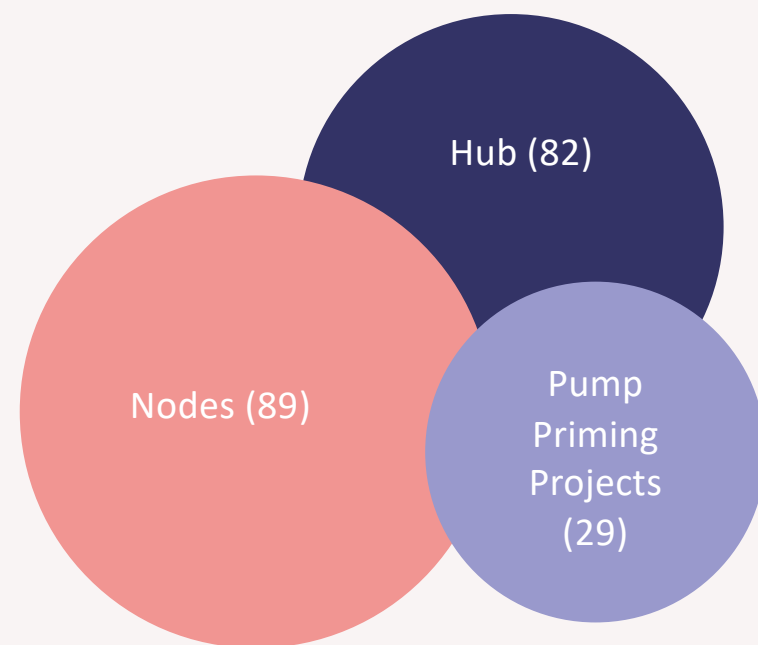
Our Advocacy and Engagement Programme covers partner, adopter, community, public, creative and policy engagement.








## Partner engagement

We have continued to onboard new Partners since inception and currently there are over 180 associated with the wider TAS Programme. New Hub Partners, since commencement in September 2020, include the Ada Lovelace Institute, The Alan Turing Institute, NHSX and the UNICRI AI and Robotics Centre.

There are 82 Partners associated directly with the Hub and 89 with the six nodes. The pump priming projects also have 29 associated Partners. A small number of Partners are associated with both the Hub, multiple nodes, and a pump priming project.

Our Partners, from multinationals, through SME's, NGOs (non-governmental organizations) and start-ups, are broadly from the key sectors outlined below:



SECTOR	EXEMPLAR CONCERNS
 Autonomous Vehicles	Safety (individual and CAVs), fair access to individuals, communities and society.
 Healthcare	Safe & ethical telecare, rehabilitation, assisted living, diagnosis, surgery.
 Industry X.0	Resilient, safe, efficient, and responsive industry. Avoiding dull, dirty, and dangerous environments.
 Financial Services	Accountable, fair, explainable, loans, insurance, trading, banking.
 IoT at home and the workplace	Data privacy, explainable and socially acceptable trusted devices, behaviours.
 Creative Industries	Understanding user expectations of future autonomous systems, trust and explain ability issues.
 Defence and Security	Ethics, legality, equality, data, privacy, for cyber security.

# Outreach

A TAS Hub Sector Leads Committee is curating engagement across a range of sectors for which autonomous systems research can be impactful. Our Sector Leads bring expertise in and connections with Creative Industries, Healthcare, Autonomous Vehicles, Defence and Security, IoT at work and in the home, Financial Services, and Industry X.0. Their role is to represent the Hub, give insights into the challenges and interests of current partners, and to recommend other partners with whom we should engage to help deliver our vision.

We are keen to leverage expertise and insights from all stakeholders on how the TAS Programme might better align to the interests and strategies of Partner organisations, and wider sectors. Organisations wishing to discuss their technical challenges are invited to contact us so we can understand the use cases and identify opportunities to work together.



# Hub partners

## Autonomous Vehicles



## Defence and Security



## IoT at home and in the workplace



## Creative Technologies



## Industry X.0



## Financial Services



## Healthcare





### Adopter engagement

We intend to draw 'reference customers' from our Partners for the TAS Programme's outputs. These will include design ideation cards for 'trustworthy-by-design' for SMEs (Small Medium Enterprises), start-ups and consumer groups.

The Strategic Advisory Network of Industrial Partners regularly advises on priority areas and provides access to relevant networks and other resources.

### Community Engagement

We have established branding and media guidelines with the aim of creating a consistent shared identity across the TAS Programme. We have also, via the Programme Co-ordination Committee, planned collaborative events involving the Hub, Nodes, and others. These include a joint conference with the Royal United Services Institute (RUSI), the UK's leading defence and security think tank and a first TAS All Hands Meeting in September 2021.

### Policy Engagement

One of the UKRI TAS Programme's key aims is to support informed policy setting in Trustworthy Autonomous Systems and we are actively monitoring the UK Parliament and other bodies to contribute evidence and develop recommendations for decision makers.

Joint UKRI TAS Hub and Horizon responses have been made to the July 2021: The future of connected and automated mobility in the UK call for evidence, March 2021: Law Commission Automated Vehicles Consultation and the January 2021: Competition Markets Authority: Algorithms, Competition and Consumer Harm call for information. These responses and other publications can be found on our website. The latter was referenced in the CMA Summary of responses to the consultation.

The TAS Hub invites researchers, industry, NGOs, and the public to engage and contribute use-cases and datasets or collaborate on research projects, tech transfer, and training activities.

### Events

The TAS Hub has had a presence at a diverse range of events this year including CogX21, the MoD Virtual AI Forum, Connected Place Catapult event on autonomous vehicles, Royal College of Surgeons Training course, Turing AI showcase workshop and the Westminster Energy, Environment and Transport Forum. We have also worked with the Royal United Service Institute (RUSI) to deliver a three-day conference and will be holding our first All Hands Meeting in September.



### 'Trusting Machines? Cross-sector lessons from healthcare and security'

Each year governments, corporations and individuals delegate more authority to autonomous systems. 'Trusting Machines? Cross-sector Lessons from Healthcare and Security' provided three days for over 360 academic experts, policy leaders, industry professionals and the public to discuss a future where autonomous machines can be responsibly integrated into healthcare and the security sectors. A concise summary for those interested in the challenges within these sectors is available from our website.

A short film 'The First,' scripted by Luca Vigano, a Hub Co-Investigator and directed by Ali Hossaini, co-Director of National Gallery X, which was watched live by the attendees of the 'Trusting Machines? Cross-sector Lessons from Healthcare and Security' conference. The film explores a future scenario where the rights of sentient beings' clash with freedom, identity, and ethical judgment.

All the creative provocations shown at the conference can be viewed in National Gallery X's AI Gallery (<https://www.nationalgallery.org.uk/national-gallery-x/the-ai-gallery>).



### TAS All Hands Meeting

The first TAS Hub All Hands Meeting (AHM), 14-16 September 2021 will bring together the whole TAS community. Each day will be themed; Day One focuses on Skills, Day Two reflects on research undertaken by the Hub and Nodes in the context of our overarching strategy, and Day Three on gathering feedback from the TAS Board and advisory bodies who are supporting us in delivering our vision for TAS.

The Hub intends to develop an understanding of the public perception of autonomous systems, as well as engage with the public to co-design and co-create socially embedded autonomous systems. A case study, around our work on understanding public perceptions of NHS (National Health Service) Test and Trace is provided here.

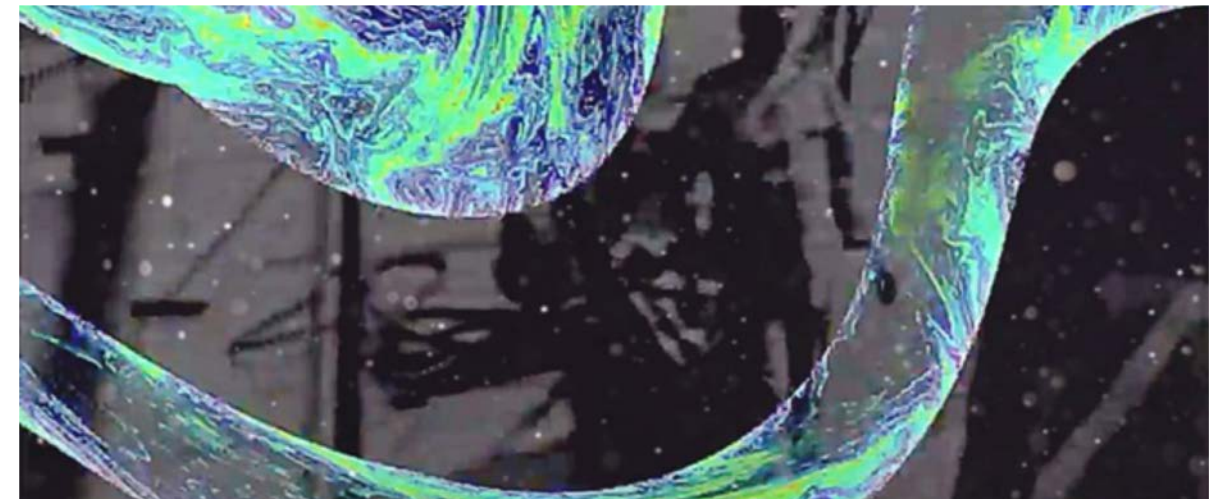
### Understanding public perceptions of NHS Test and Trace

In the summer of 2020, we carried out a series of preliminary interviews with members of the public to understand their perceptions of the proposed test and trace system in the UK. We used their responses to help us design an online survey probing the use of, understanding of, and attitudes towards the NHS Covid-19 app after release. The survey was carried out by Ipsos Mori in November 2020, who recruited a representative sample of 1001 UK participants, weighted to the known offline proportions for age within gender, region, working status, and ethnicity. Simultaneously, we released the survey online ourselves, collecting 53 responses and inviting participants to register interest in a subsequently interview (n=16).

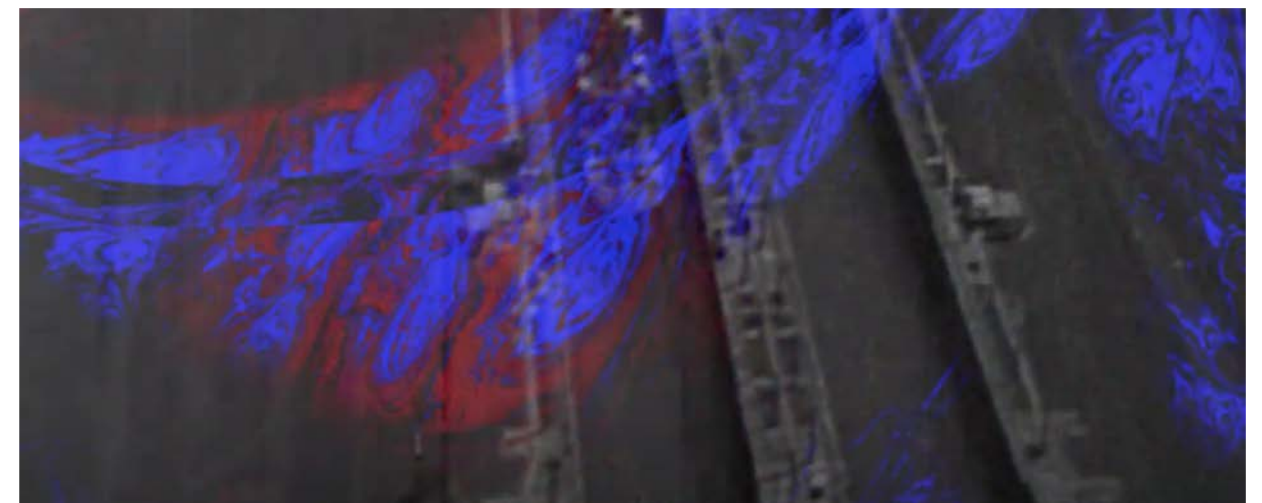
Data collected from the Ipsos study have been submitted (and accepted) for publication in the Journal of Medical Internet Research. Members of the team are also carrying out a thematic analysis of the interview data from last summer, which we will compare with further interviews on the actual use of the app in the coming weeks. Furthermore, we are also carrying out linguistic analysis of the media surrounding the pandemic since the start of lockdown, to complement our test and trace attitude studies.

### Creative Engagement

Our creative engagement programme is led by Professor Steve Benford and Dr Alan Chamberlain. Currently we have four artists in residence and in collaboration with National Gallery X have commissioned more than 10 creative provocations this year, these can be viewed in the AI Gallery.



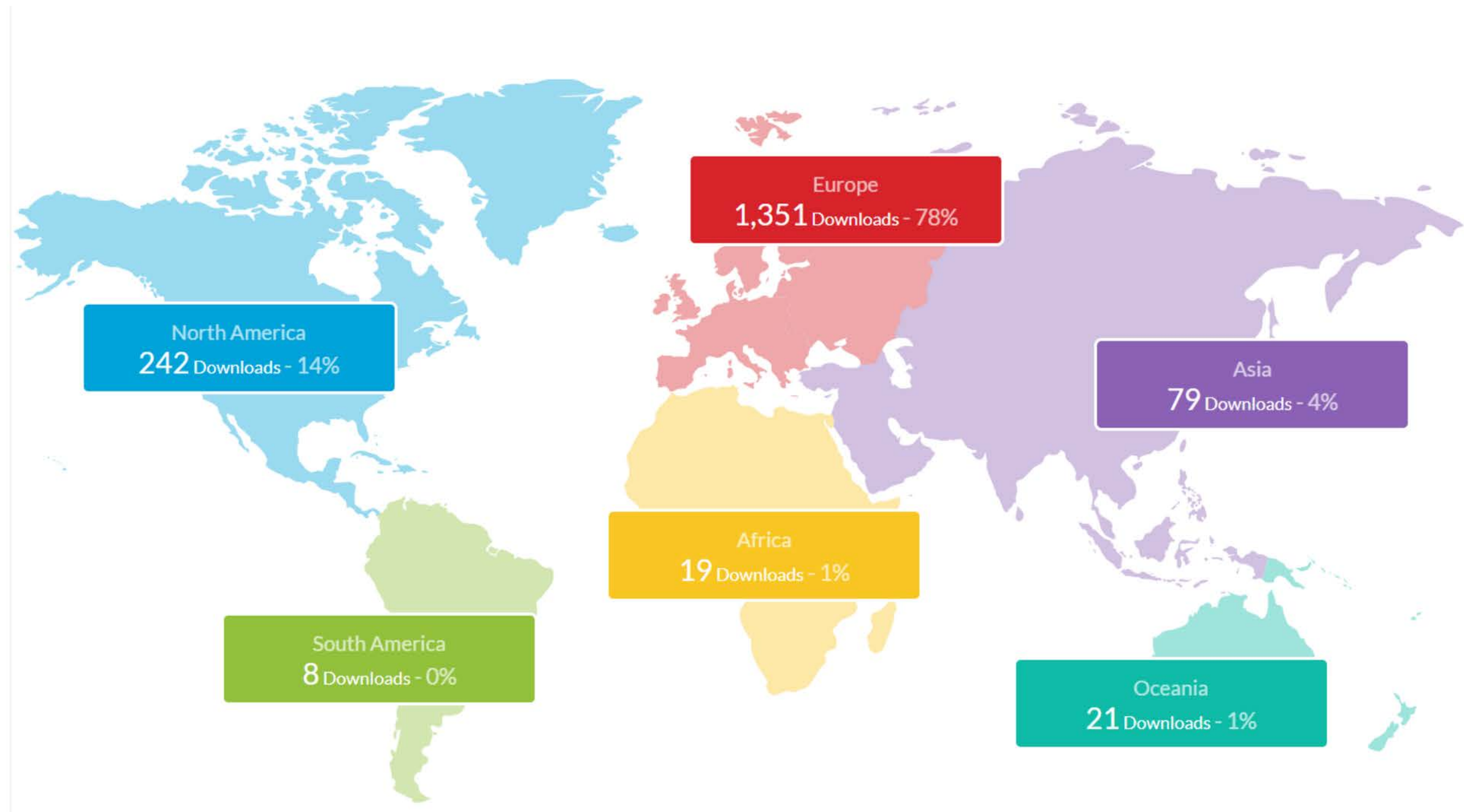
**Flow: artist Alan Chamberlain; on display at the National Gallery X**  
(<https://www.nationalgallery.org.uk/national-gallery-x/the-ai-gallery>).





# Podcasts

The living with AI podcast, which feature a speaker and panel drawn from the TAS Community have covered such diverse topics as track and trace, virtual assistants, drones, driverless cars, music, robotic surgery, and legal and ethical issues of autonomous systems. All episodes are available on our website. In July 2021, the podcasts have had over 1,700 downloads from around the world.





# TAS conversations

The first of these contemporary fire-side chats assembled a panel, comprising Dr Jack Stilgoe, Sean Riley (host), Dr Jo-Ann Pattinson, Professor Mohammad Mousavi, Dr Siddartha Khastgir and Professor Sarah Sharples, to discuss issues surrounding 'Trust in Autonomous Vehicles.' (The conversation is available at [https://bit.ly/TAS\\_convoAV](https://bit.ly/TAS_convoAV))



“

We don't get to decide what gets trusted that's for society it's ultimately a democratic question...the things that determine trustworthiness are not just whether a system does what we expect it to do right which are the sort of things that engineers can check and certify and assure ... but often people are interested ...in what systems are for ... in the purposes of technology and the trustworthiness of these systems might be undermined by for example their use in cutting people's jobs or their use in enabling rich people to get about but doing nothing for poor people so trust is a really complicated multi-dimensional issue

**Dr Jack Stilgoe, Associate Professor of science and technology studies, University College London**



“

Think about the subtleties of human behaviour that happen as you stop at a zebra crossing ... because you stop you observe you don't just observe whether there's a person and whether they're walking across the zebra crossing you observe the age of that person you observe whether they've got mobility impairments of some sort and they might need to walk more slowly you might even have a little friendly wave or a smile at the person ... and we're talking about what five ten seconds of interaction here .. the complexity of programming all of those different possibilities is absolutely enormous but also let's remember that humans are sentient beings and actually it's quite nice if you're driving along and you stop and you have a pleasant interchange with a pedestrian

.. are we really talking about fully autonomous vehicles or are we talking about vehicles that really help you in those situations where we know that human fallibility comes to the fore so one of the things that is a human cognitive and physiological limitation is fatigue and distraction .. fatigue and distraction comes much more into play when we're motorway driving so the case for autonomous vehicles in a motorway setting is much stronger than in that sort of city or town type environment where not only is it much more complex to design autonomy but actually also humans are often brilliant

**Sarah Sharples, Chief Scientific Advisor, Department for Transport**

A further TAS Conversation around the EU (European Union) AI Act will be held live on 4 October. Confirmed panellists include Professor Dame Wendy Hall (TAS Hub Skills Director), Carly Kind (Director, Ada Lovelace Institute) and Professor Subramanian Ramamoorthy (Principal Investigator TAS Governance and regulation node).

# The future

## We intend to

01

Embed a TAS shared identity across the programme, establishing ways of working between the hub, nodes and partners that helps to grow new relationships and builds trust.

02

Continue to create and work towards a balanced portfolio of projects from the ground up to address known research problems and establish a series of collaborative events that bring the TAS community together with others (industry, government, and other research groups) to help shape research.

03

Evaluate existing policies in the TAS landscape and contribute to policy consultations

04

Promote the TAS EDI framework

05

Continue to develop the creative engagement programme to generate debate with a wider audience

06

Engage with the public to define research questions as part of research projects

07

Establish baseline requirements for TAS skills via skills-related activities and research projects.

# Appendix

## Our definitions



### **Autonomous System**

A system involving software applications, machines, and people, that is able to take actions with little or no human supervision.



### **Trust in Autonomous Systems**

Trust is defined in many ways by different research disciplines. The TAS programme focuses on those notions that concern the relationship between humans (individuals and organisations) and autonomous systems.



### **Trustworthy Autonomous Systems**

Autonomous systems are trustworthy when their design, engineering, and operation ensures they generate positive outcomes and mitigates potentially harmful outcomes. Whether they are trusted depends on a number of factors including but not limited to:

- Their robustness in dynamic and uncertain environments.
- The assurance of their design and operation through verification and validation processes.
- The confidence they inspire as they evolve their functionality.
- Their explainability, accountability, and understandability to a diverse set of users.
- Their defences against attacks on the systems, users, and the environment they are deployed in.
- Their governance and the regulation of their design and operation.
- The consideration of human values and ethics in their development and use.





# Thank you



UKRI  
**Trustworthy  
Autonomous  
Systems Hub**

To our funders



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