ANNUAL REPORT 2021

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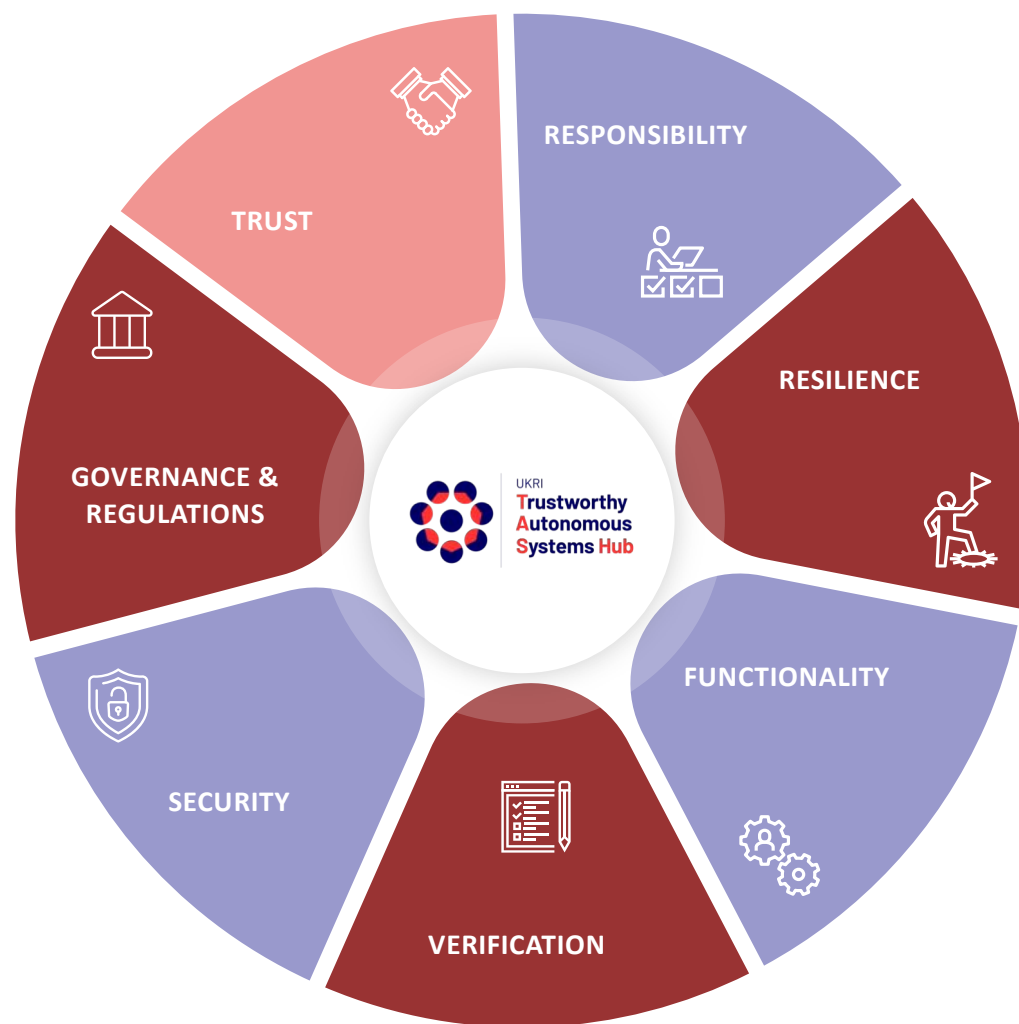
The
Nodes
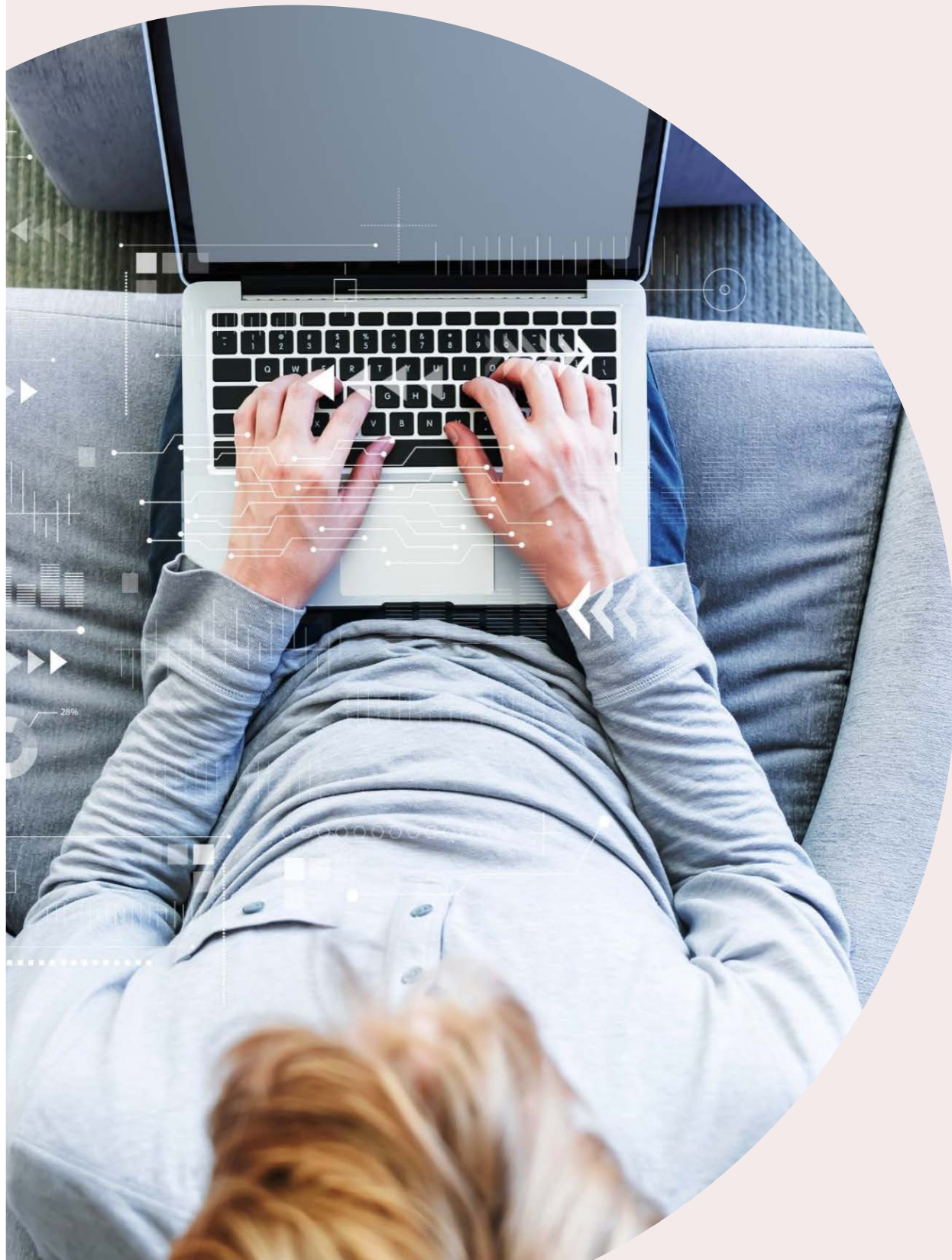
The Functionality node will investigate how we can create processes that will build trust in autonomous systems, rather than just building the technologies themselves.

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

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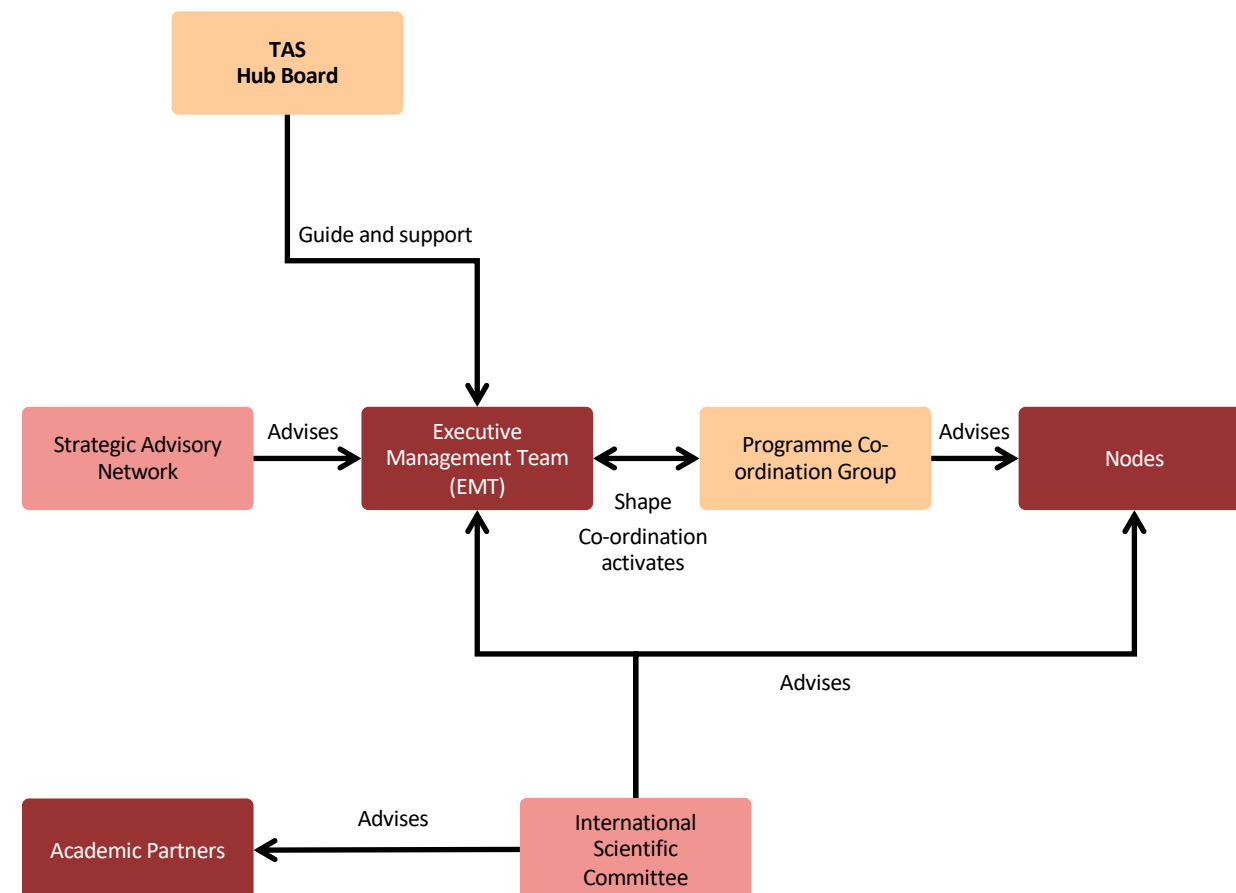
The Hub Governance and advisory boards, outlined below, provide the Executive Management Team with guidance and advice on the direction of the Programme and challenge the team. It is through regular meetings that these committees help the Hub to set out strategic direction and foundation for all our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

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 Victoria Mico-Egea, UKRI Programme Manager

Dr Marion Oswald, University of Northumbria

Dr Jack Stilgoe, University College London

Angela Westley, Head of Operations UKRI TAS Hub

Dr Alvin Wilby

Adrian Woolard, British Broadcasting Company (BBC)

Professor Sarvapali Ramchurn, Director UKRI TAS Hub

Professor Derek McAuley, Deputy Director UKRI TAS Hub

Professor Luc Moreau, Deputy Director UKRI TAS Hub

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

Irakli Beridze, UNICRI

Nik Bhutani, Northrop Grumman

Ben Coomber, UKRI TAS Hub Operations Team

Hector Figueiredo, Qinetiq

Joel Fischer, Research Director UKRI TAS Hub

Darminder Ghataoura, Fujitsu

Paul Gosling, Thales

Nadine Hachach-Haram, Proximie

Rhianne Jones, BBC

Mohammad Mesgarpour, Microlise

Luc Moreau, Deputy Director, UKRI TAS Hub

Shamma Mustapha, Boeing

Elvira Perez, Responsible Research, and Innovation Director, UKRI TAS Hub

Robert Skilton, UKAEA

Peter Stockel, Dstl

Sridhar Sudarsan, Sparkcognition

Ruth Taylor, Maritime and Coastguard Agency

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).

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.

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.

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 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.

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 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 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 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 Vigano

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

Healthcare

Professor Adriane Chapman

Professor Prokar Dasgupta

Professor Diana Eccles

Dr Matthew Rawsthorne

Industry X.0

Dr David Branson III

Professor Susan Gourvenec

Hub

Professor Luc Moreau, Deputy Director

Louise Male, Transformation Manager

Dr Elvira Perez, Responsible Research,
and Innovation Director

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 Siddartha 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

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

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.

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.

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.

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.

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.

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?
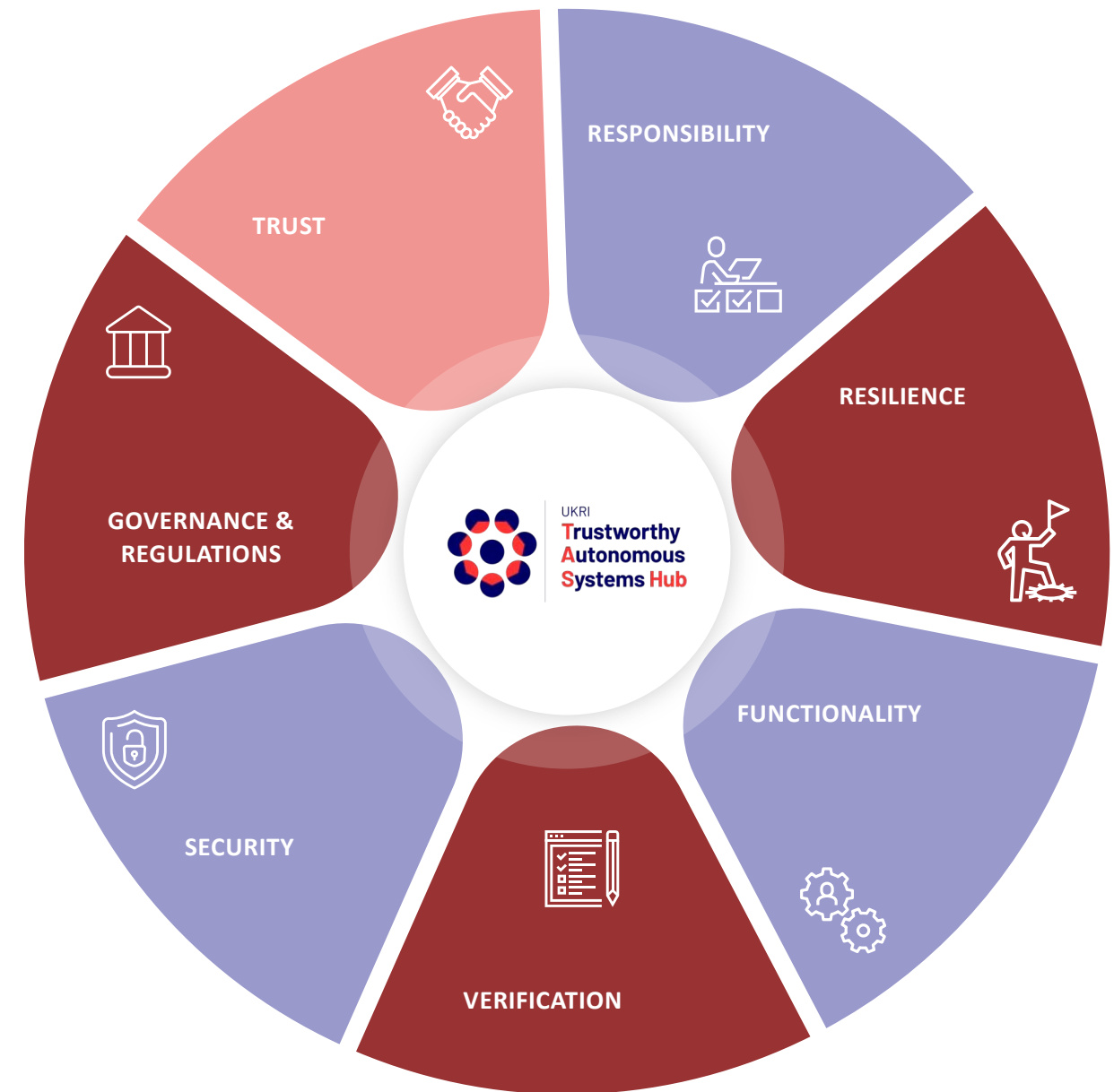
HERIOT WATT UNIVERSITY   Imperial College London   MANCHESTER 1824 The University of Manchester

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

KING'S College LONDON   UNIVERSITY OF LEEDS   UNIVERSITY of York   MANCHESTER 1824 The University of Manchester   The University Of Sheffield   UNIVERSITY OF LEICESTER

TRUST

RESPONSIBILITY

RESILIENCE

GOVERNANCE & REGULATIONS

UKRI Trustworthy Autonomous Systems Hub

FUNCTIONALITY

SECURITY

VERIFICATION

Research Programmes

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

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.
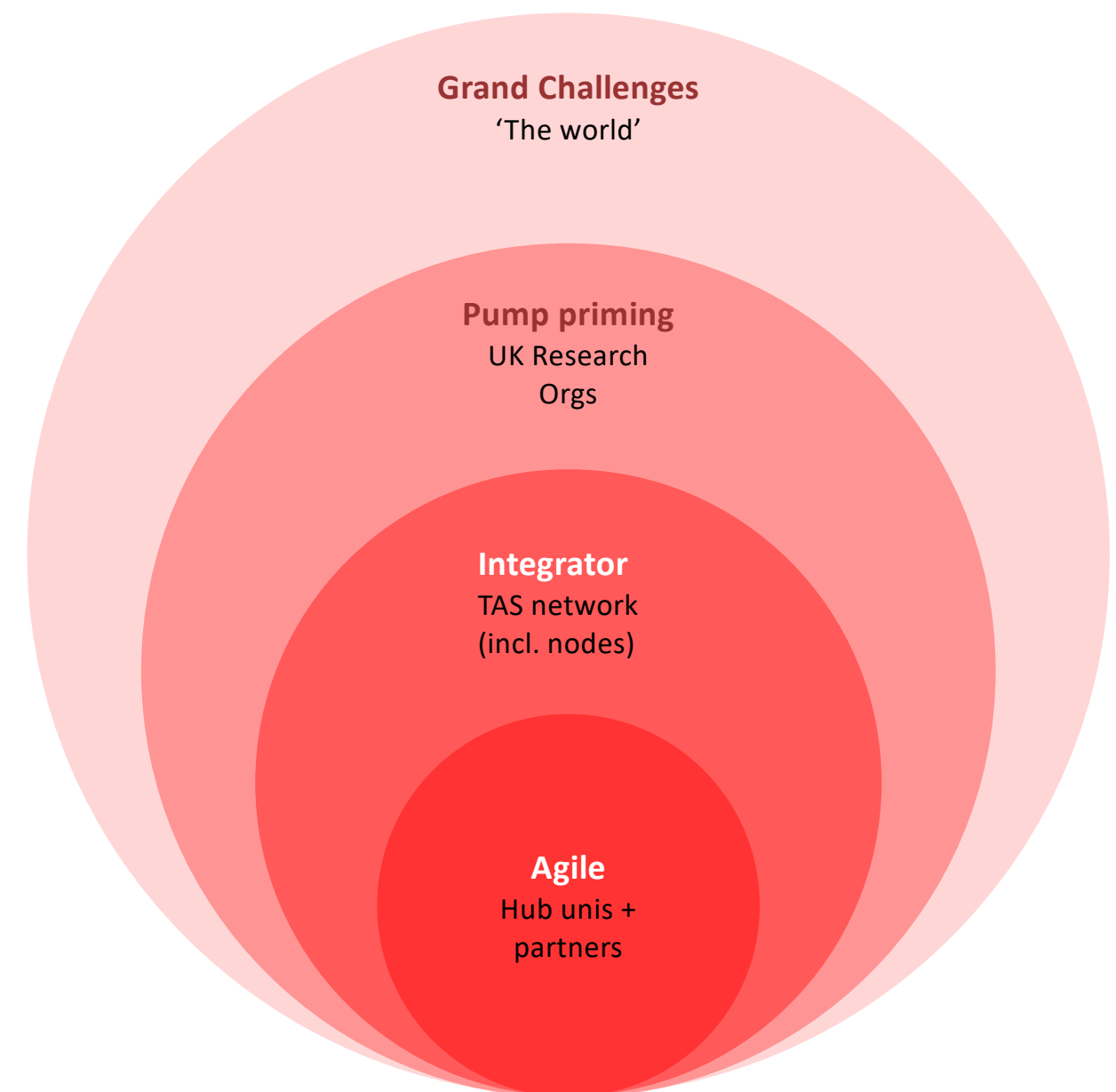
PP

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.

Grand Challenges
'The world'

Pump priming
UK Research
Orgs

Integrator
TAS network
(incl. nodes)

Agile
Hub unis +
partners

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

SA²VE: 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. SA2VEsets 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
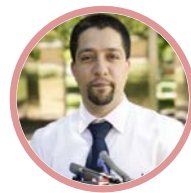
Farshid Amirabdollahian

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
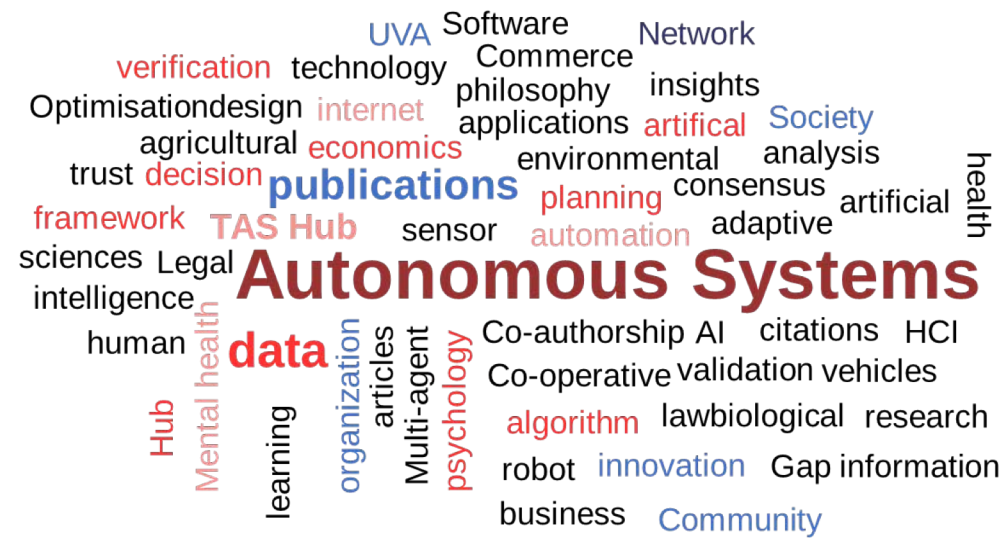
Trust Me? (I'm an Autonomous Machine)

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.

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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.

UVA Software Network
verification technology Commerce insights
Optimisation design philosophy internet applications artifical Society
agricultural economics environmental analysis health
trust decision **publications** planning consensus artificial
framework TAS Hub sensor automation adaptive
sciences Legal
intelligence **Autonomous Systems**
human **data** Co-authorship AI citations HCI
Hub Mental health organization articles Multi-agent psychology Co-operative validation vehicles
learning algorithm law biological research
robot innovation Gap information
business Community

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 behavious 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 Juljan 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:

Hub (82)

Nodes (89)

Pump Priming Projects (29)
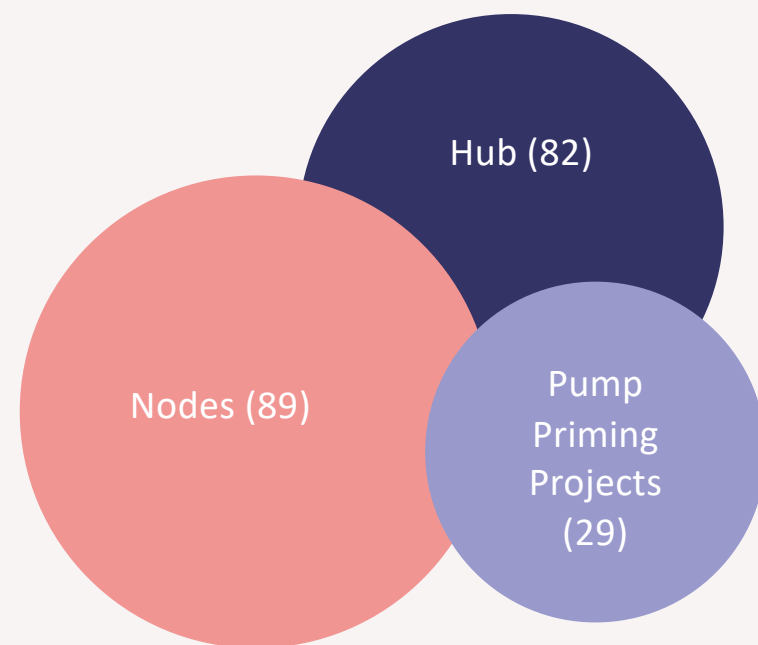
SECTOR	EXEMPLAR CONCERNS
Autonomous Vehicles	Safety (individual and CAVs), fair access to individuals, communities and society.
Healthcare	Safe & ethical telecare, rehabilitation, assisted living, diagnosis, surgery.
Industry X.0	Resilient, safe, efficient, and responsive industry. Avoiding dull, dirty, 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

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).

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).

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.
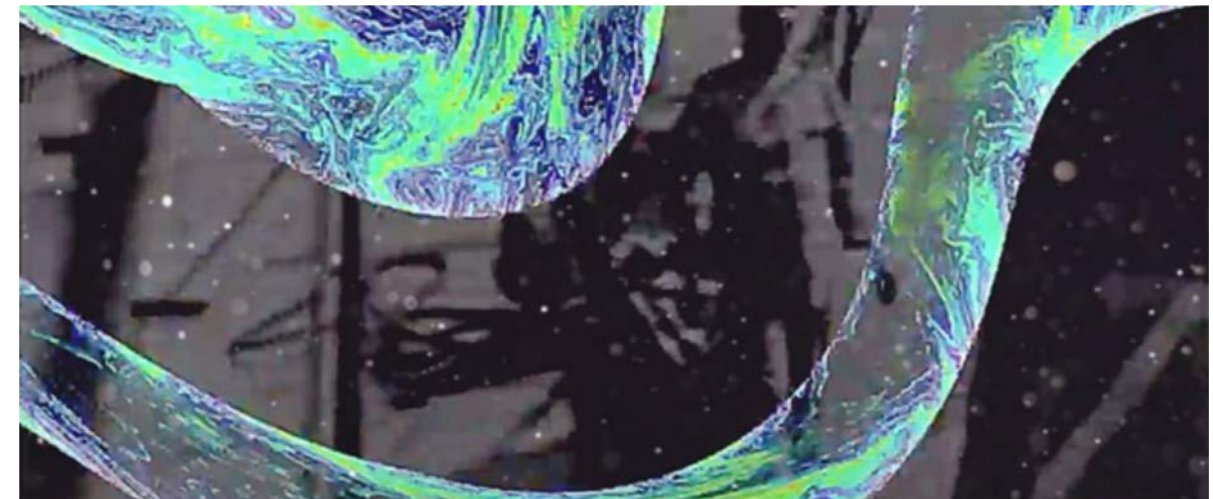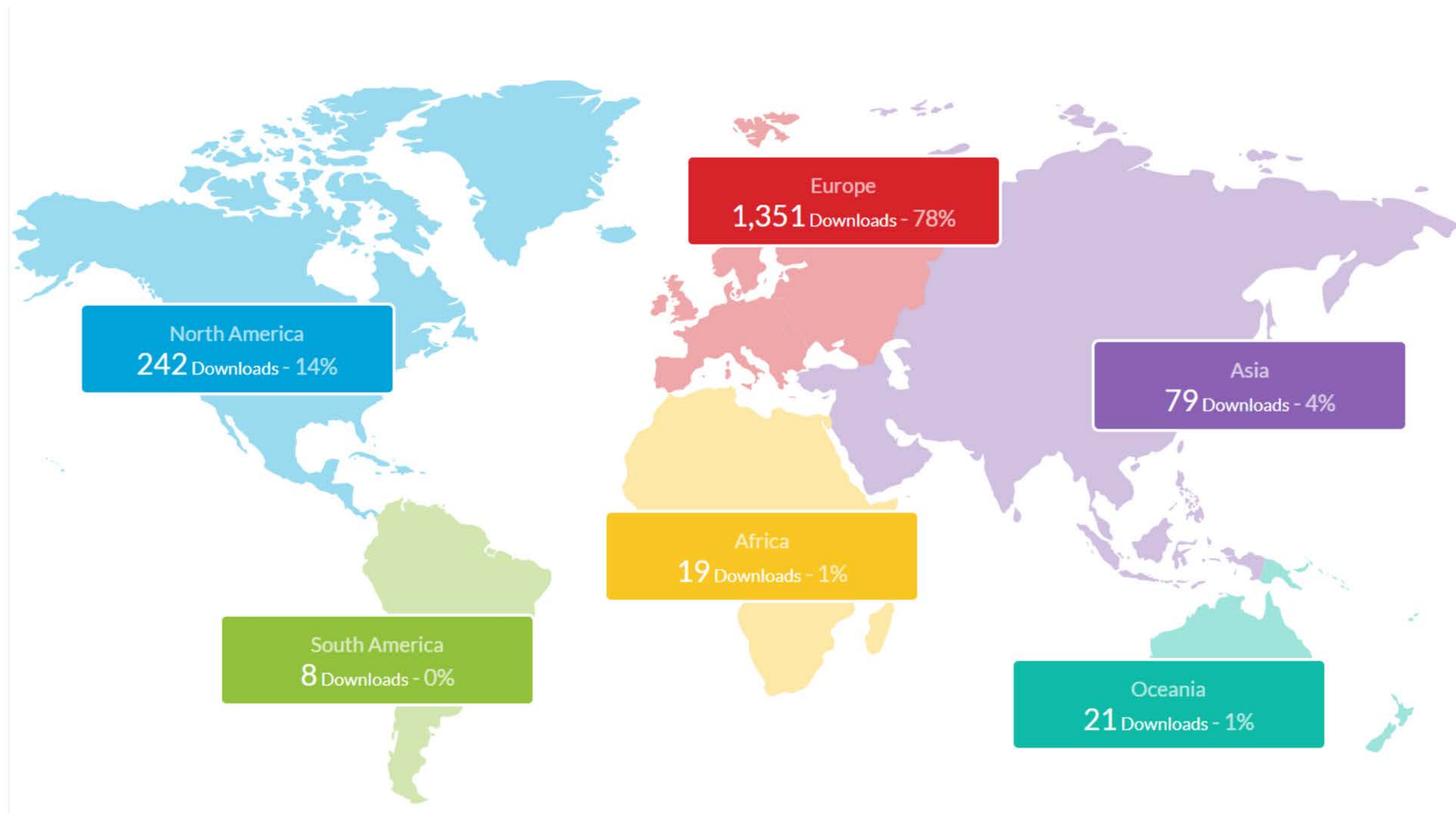
Podcasts

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.

Europe
1,351 Downloads - 78%

North America
242 Downloads - 14%

Asia
79 Downloads - 4%

Africa
19 Downloads - 1%

South America
8 Downloads - 0%

Oceania
21 Downloads - 1%

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)

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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

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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

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Autonomous System

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

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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.

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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

Trustworthy Autonomous Systems Hub

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