Science
& Technology
in Policing

POLICING

AREAS OF RESEARCH INTEREST

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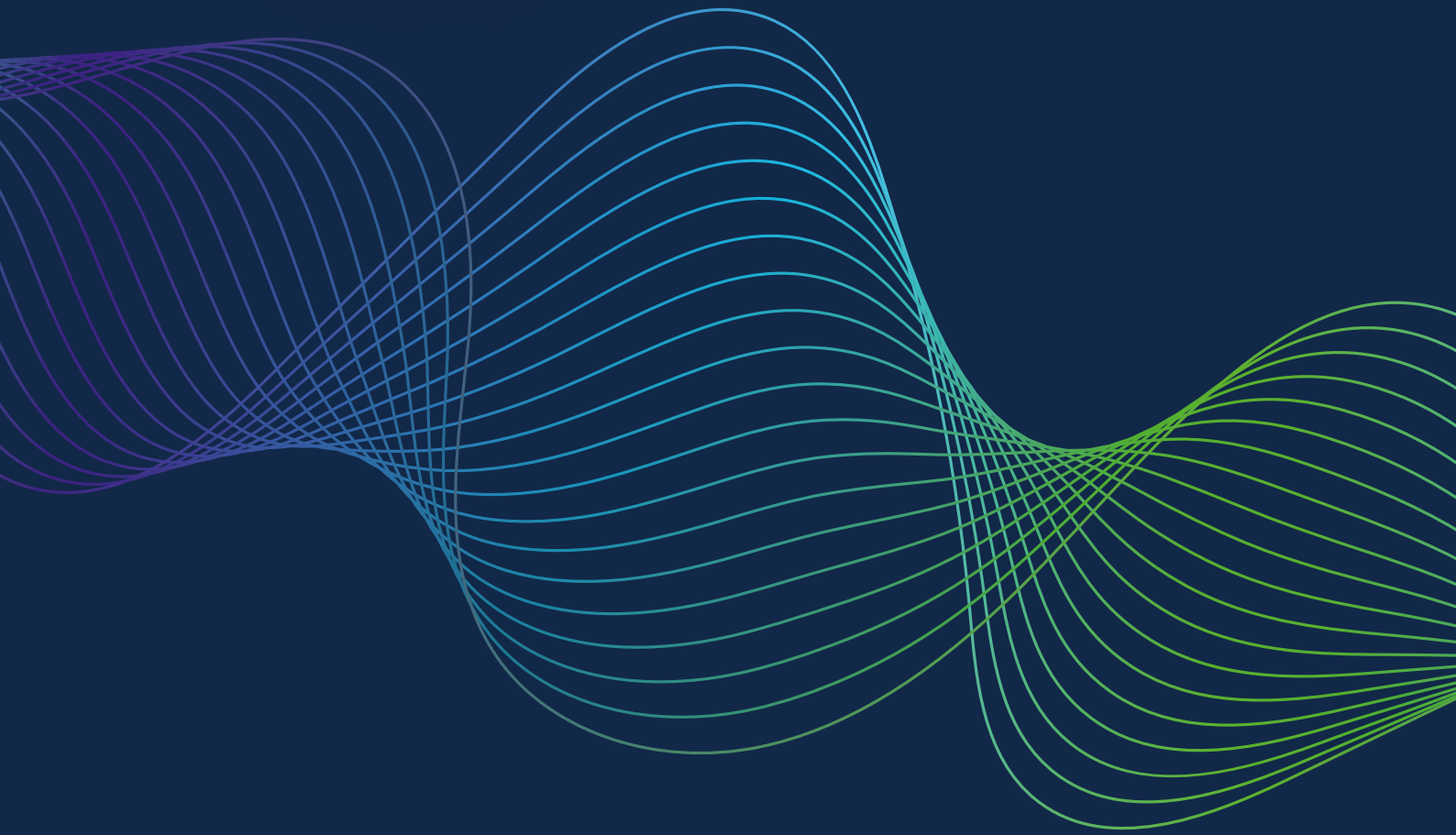

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Introduction

We committed in our first Science and Technology (S&T) strategy to publish policing's Areas of Research Interest (ARIs). An ARI is a statement about a science, technology, analysis, or research (STAR) challenge that, if addressed, will in our view significantly improve policing performance.

Our reason for publishing ARIs is to be transparent about the areas that the National Police Chiefs' Council (NPCC) will prioritise when investing and collaborating with academia, industry, the voluntary sector, and our government partners. Most of what we have to gain will come from partnerships. Our ARIs are part of a wider effort to make it easy to work with us. I hope they give a clear sense of policing's 'demand signal' and where we might usefully work together.

The breadth of policing's interests makes it easy to produce an overbearing set of ARIs. To help readers, we marshal our interests not in the traditional way of a capability (e.g., face recognition) but in terms of service lines — what problem is the S&T seeking to solve? Our service lines are:

Crime prevention
The ability to understand and respond to drivers and inhibitors of crime, including crowd management, public trust, mental health and wellbeing

Personal safety
The ability to protect our workforce and members of the public through e.g., body-warn equipment, location resilience, less lethal weapons

Mobility
The ability to move to/from locations quickly to prevent, detect, or respond; access difficult locations safely to maximise intelligence and minimise risk

Identification and tracing
The ability to trace, attribute, and confirm the identity of a person, location, activity, etc., to evidential levels, such as tracing missing persons

Surveillance and sensing
The ability to lawfully monitor and collect data from people, activity, movements, behaviours, objects and data overtly and covertly

Analytics
The ability to synthesise information to draw insights that can lead to actionable decisions, often in combination with other information and at scale

Interconnectivity
The ability to pass information quickly, accurately, and securely, and the ability to intercept or disrupt communications of others

The ARI formulation was a community endeavour — the result of engagement with NPCC Coordination Committees, national enablers delivering science, technology, analysis and research across forces, and our wider partners. The top-level ARIs presented here are complemented by an emerging set of organisation-specific ARIs that capture domain needs. These may be accessed via links on science.police.uk

All who engaged in the development of policing's ARIs thought carefully about our priorities — what we need for today, what we aspire to have, and where we will focus our efforts with partners. I'm grateful to all for doing so.

Professor Paul J Taylor
Police Chief Scientific Adviser

1 Enduring challenges

Our Areas of Research Interest are underpinned by three enduring challenges that are relevant to all of the service lines. We are keen therefore that they are given prominent consideration in everything that we do.

1 Building and maintaining public trust

The NPCC commits to delivering innovation that is proportionate, fair, ethical, legal, and supported by the public. We have a 'transparency first' ethos, viewing this approach as one of many of our efforts to build public trust. Thus, underpinning all our ARIs is a need to understand how the public feels about the S&T. We thus seek to understand public perceptions, beliefs, and concerns about our existing and emerging capabilities. We also wish to understand how best to communicate our ambitions, decisions, and use of S&T to improve public awareness and understanding.

2 Future workforce and training

We seek to increase the scientific expertise of our specialists and our wider workforce, to drive scientific thinking across the service. We need our specialists to have the latest skills and knowledge, and we need our workforce to be intelligent consumers and users of S&T. Thus, underpinning each of our ARIs is a need to consider workforce skills and capabilities, as well as novel methods of delivery. Where possible, this is likely to involve 'democratising' S&T so that it can be used by many while our specialists focus on acute and complex cases. We also wish to identify effective pedagogy, learning technologies, and research on organisational design that will enrich and promote a 'science and evidence first' culture.

3 Responding to the climate crisis

With its significant public sector footprint, policing must lead the way in delivering a sustainable future for the UK. We wish to address both our Net Zero challenges, such as how to effectively replace a fuel-based car fleet, but also seek to address sustainability in all our S&T development and procurement. Thus, underpinning each of the ARIs is a desire to establish sustainable supply chains that deliver solutions that contribute to policing's Net Zero commitments. As part of this, we recognise the need to also identify the impact of climate change on criminality and policing's operating model, so that we can adapt and build resilience to the down-stream consequences of global warming.

2 Crime prevention

Prevention is the ability to understand and respond to drivers and inhibitors of crime across a range of contexts.

Safe public spaces

What behavioural and technical interventions will improve the safety of public spaces and the public's perception of their safety? Our core interest is securing robust evidence of 'what works,' for whom, when, and where (see the College of Policing's Practice Bank). In asking this question we recognise the diversity of our communities and populations and the need to understand the value and impact of prevention initiatives within these contexts. Our interest extends to online spaces and the technologies that can help prevent crimes and enhance public safety, including the prevention of online mobilisation toward violence and terrorism. Finally, as outlined in the NPCC Roads Policing Strategy, we continue to prioritise road safety and are interested in S&T led interventions that encourage and support safer driving.

Evidencing the value of prevention initiatives

How can we best assess and evidence the benefits of crime prevention initiatives? What methods and expertise can we borrow from evaluation programmes in education and health? By collating this evidence, we are interested in identifying both where further testing is needed and where initiatives may be having disproportionate impacts that are biased or discriminatory. Critically, we are interested in approaches that consider the breadth of public services and, in doing so, help root policing's role in public health responses.

Risk mitigation

The development of evidence-based risk and threat management frameworks that enable best use of policing resource and the effective prevention of crime. Interventions may range from macro-policy changes to location and time-specific measures, such as making property more difficult to steal, reducing the market for stolen goods, or changing incentive structures (behavioural 'nudge'). Our interest extends beyond crime to organisational risk, such as how we can improve our workforce vetting processes. We are particularly interested in methods that increase the precision of policing's risk modelling and the subsequent actions that we undertake.

3 Personal safety

Personal safety is the ability to protect our workforce and members of the public.

Wellbeing

We believe S&T is central to our effort to identify and address wellbeing concerns, including by mitigating trauma in the first place. We wish to identify and take advantage of emerging technologies (e.g., wearables) that can help identify people who may be struggling before they reach crisis point (e.g., through analysis of psychophysiological data), enabling earlier interventions that include science-informed changes to their workplace. We recognise that the success of these innovations is dependent on workforce acceptance and engagement, and we seek to learn what innovations staff would use and find supportive. We are also interested in technologies that can mitigate the trauma our staff experience by the nature of their work. A successful example of this is using advanced computer vision to identify traumatic child exploitation images, to reduce the burden on staff making manual assessments.

Next generation uniform

Combining advanced materials and sensor technologies offers significant opportunities for a lightweight, multi-functional, well-fitting Personal Protective Equipment. We wish to learn about the main candidate materials (e.g., carbon graphene, shear thickening fluids) and what might be possible with connectivity and sensor functionality. For example, how could we utilise sensors to monitor officer stress and fatigue? Or functionality that provides environmental and situational awareness, such as the presence of narcotics or pollutants/CBRN (Chemical, Biological, Radiological and Nuclear)? How do we power these sensors efficiently? All of these developments are of interest, though ultimately policing will need to balance cost and functionality.

Lawful detection and interdiction

We seek novel solutions that allow officers to make safe and proportionate lawful interference in two areas:

1. vehicle interdiction, particularly as it relates to stopping e-scooter and e-bike crime; and,
2. stand-off knife detection, enabling swift resolution for officers in a safe manner.

We have seen great progress against both challenges, but there remain questions over how to achieve usable SWaP (Size, Weight, and Power) configurations and the pros and cons of different candidate technologies for different scenarios. As in many areas, development here will combine advances in sensors, power, and computation.

4 Mobility

Mobility is the ability to move to/from locations quickly to prevent, detect or respond, including to access difficult locations safely to maximise intelligence and minimise risk.

Autonomous Vehicles

Autonomous vehicles, and particularly a combination of drones and fixed-wing Unmanned Aerial Vehicles, offer a faster, safer, cheaper, and more sustainable means of frontline deployment and advanced evidence capture. The National Police Air Service and the NPCC's National Lead for Drones have a joint strategy that sets out in detail the technical challenges we must overcome to be able to operate a suite of complementary response options. These relate to concerns over line-of-sight flying, safety, cybersecurity, costs of replacement and maintenance, expertise required to use, and poor battery life. Each of these need to be addressed alongside extensive consultation to ensure our use is understood by the public, considered proportionate, and supported.

Advanced robotics

We are interested in exploring how low-cost swarm robotics could expedite activities such as crime scene analysis. Could robotics effectively support our forensic specialists identify, record, or assess marks across a scene? How might they complement existing provision to, for example, enable forensic specialists to concentrate on complex or central evidence? We anticipate that robotics will be particularly valuable in challenging environments and hard to reach locations. How can we use advances in robotics to reduce or remove the need for police officers to enter hazardous environments (e.g., water, fire, electrical, natural disaster, CBRN), to rescue and treat casualties and bring the situation under control? What is needed to enable seamless and secure operation in such environments? As autonomy and AI improve, robots may become smarter and more able to operate independently of their operators, which may lead to complex ethical, operational, and legal challenges that we seek to understand.

Carbon neutral alternatives

To work effectively, policing needs a vehicle fleet capable of delivering performance and performance-weight differentials that exceed those required in the commercial market (e.g., in emergency vehicles carry heavy tactical equipment). We are therefore keen to see novel development of sustainable fleet alternatives as part of a wider effort to meet our Net Zero target. We are also prioritising research and design-focused interventions that allow us to identify different ways of responding to incidents. That is, we see moving to a carbon neutral service will require a combination of new technologies and new 'carbon efficient' practices.

5 Identification and tracing

Identification and tracing is the ability to trace, attribute and confirm the identify of a person, location or activity to evidential levels.

Image processing at scale

We seek a step-change in our ability to process and fuse audio-visual materials, from CCTV, ANPR (Automatic Number Plate Recognition), video, smart doorbells, smartphones, and social media, as well as materials from developing platforms such as virtual reality, online gaming, and the metaverse. Challenges include collection, processing, and storage (of usually large files), identifying manipulation or spoofing, working with still compared to moving images, and maintaining the evidential chain. We are interested in computational and analytical techniques that deliver accurate, large scale, automated image capture, processing, and amalgamation, which maintain privacy and proportionality. We are interested in what counter technologies might be used to trick these systems and what we can do to mitigate this. Unsurprisingly, utmost in our interest here is the detection and mitigation of deepfake imagery and video. What methods and policies could policing use to identify deepfakes rapidly and automatically, while retaining victim privacy?

Emerging biometrics

We seek to understand emerging biological or behavioural measurements or calculations that can be used to ascertain or impersonate a person's identity. Advances in analysing microbiomes (the combination of microbes unique to individuals) and genetics could lead to new ways to identify and track criminals from traces left behind. Similarly, as computational power increases, so the ability to measure and identify data characteristics unique to a person increase. This puts at risk people's right to privacy while, simultaneously, providing new ways to demonstrate beyond reasonable doubt a person's location, supporting existing forensic approaches. We are keen to understand what potential criminal and investigative opportunity is emerging and what the limits are of biometrics.

Digital forensics

The ability to manage the variety and quantity of digital forensic material recovered during investigations, in a manner that maintains privacy and minimises the intrusion for victims, is an urgent priority for policing. Our interests span multiple disciplines since we seek not only best-in-class digital tooling for the analysis of text, media, and metadata, but also improvements in process, workflow, and our ability to ensure digital forensic awareness across the workforce. This includes 'democratising' the ability to run safe, rapid, and effective forensics at scene, be it through 'lab in a box' technologies or by other means. We are particularly interested in advances that can support crypto-currency investigations.

6 Surveillance and sensing

Surveillance and sensing is the ability to lawfully monitor and collect data from people, activity, movements, behaviours, objects and data overtly and covertly.

Vulnerable interviewing

We wish to develop practices that support vulnerable witnesses, victims, and suspects at interview. We seek best practices in conducting:

1 Pre-interview assessments, to identify vulnerability or intimidation (within the meaning of the Youth Justice and Criminal Evidence Act, 1999), to determine which 'special measures' are appropriate, and to establish how best to communicate;

2 Voluntary Attender Interviews with suspects using secure digital recording devices, including understanding the impact this approach has on interview quality, the outcome of the investigation, and jury decision making;

3 Investigative interviews with vulnerable suspects, establishing the extent current national police interview models are fit for purpose when conducting interviews with vulnerable suspects, such as those who have Autism Spectrum Disorder, Personality Disorder or mental health conditions; and,

4 A suspect centric approach in RASSO (Rape and Serious Sexual Offences)/VAWG (Violence Against Women and Girls) investigations to determine how to structure suspect interviews if a suspect's previous behaviour has an impact on 'consent' (s74-76 SOA 2003).

Next generation sensing and signal processing

We are interested in how policing can make use of, and respond to, the rapid developments in sensor technologies and the increasingly diverse data emerging from our digital lives. We seek to both understand new opportunities for evidence and intelligence gathering, as well as the new crime possibilities these developments create so that we can respond, and also the. The examples of interest include 'lab in a box' technologies that offer rapid, real time forensic analyses by people not necessarily requiring significant training to operate, use of novel data sources such as advertising technology, the use of novel millimetric wave sensing to identify hidden objects, and the use of low orbit satellite to augment existing sensing capabilities. We are particularly interested in resilient sensing in congested environments.

Next generation situational awareness

The ability of Chief Officers to have real-time information about policing's workforce and technical assets is central to delivering an efficient and effective operational response. We seek to capitalise on geospatial technologies to deliver new information forms that can enhance situational awareness and decision making. The information we seek to provide includes asset tracking, document, video and image transfer to deployed officers, remote briefing capabilities, electronic logging, improved transparency, and accountability in relevant operations. We are equally interested in research that helps us understand how best to implement and utilise situational awareness within policing practices.

7 Analytics

Analytics is the ability to synthesise information to draw insights that can lead to actionable decisions.

Methods to improve data quality

The value of analytics to policing rests on the quality of the data on which it can draw. We are therefore interested in technical and behavioural methods that can be used to improve the quality of data within police systems? Our core interests relate to reducing the burden on users, correcting inputs, measuring data quality, and enriching data from other sources where it is legal and proportionate to do so. There are near-term opportunities through Robotic Process Automation that we are seeking to maximise, but we are equally interested in novel solutions and system changes that advance how we create, store, and utilise our diverse data sources.

Tools to support processes and compliance

We are particularly interested in analytic techniques that relieve our workforce of administrative tasks and/or support their compliance with analytic or data governance standards (NPCC's Covenant for Using Artificial Intelligence (AI) in Policing). Our interests include developing mature capabilities such as automatic redaction and selective extraction from phones, to creating new support processes in areas such as Out of Court Disclosures, personnel vetting, and document summarisation. We retain a broad interest here because we seek to learn the value and limits of emerging technologies, such as ChatGPT, as well as continuing to exploit Advanced Data Analytics across the range of processes and questions relevant to policing.

Public understanding and consent

We recognise that our increasing use of analytics, including in areas such as risk assessment, come with an obligation to ensure the public understand what we are doing and consent to it. To achieve this requires deriving better answers to a set of questions that afford the public transparency and voice. These include: How can we co-develop useful predictive models with public debate and consent? How can we demonstrate that algorithms are fair and unbiased in using policing data? How can we ensure transparency in decision-making, so it is open to challenge? How can we measure and demonstrate the level of accuracy in predictive algorithms? How much weight should policing place in them? What is the evidence base for using these techniques? We identify this as a separate ARI because it is central to our overarching ambition to build public confidence and because we believe research is needed to develop best practice.

8 Interconnectivity

Interconnectivity is the ability to pass information quickly, accurately and securely, and the ability to intercept or disrupt communications of others.

Fast/flexible data fusion

The scale and complexity of police information means that fast, reliable, and flexible fusion and linkage across datasets is not a straightforward process. We are interested in methods that enable data fusion or linkage to enrich the evidence or intelligence picture, across structured and unstructured sources. We are interested in all methods, but they must be usable within the character of our working environment, in terms of varying data protection impact assessments, data quality, and the proportionate need for access. Methods that retain the anonymity of identifiers are of particular interest as they can enable us to better work with our partner agencies. As part of this challenge, we are interested in understanding how enriched data should best be presented to a user to enable rapid and effective decision making.

Next generation interconnectivity

The effectiveness of many aspects of policing, from work with public health partners, to engagement with the criminal justice system, to management of a large-scale emergency, requires efficient information sharing. How can policing advance its interconnectivity both within policing (e.g., AI supported call and response routing), on multi-modal devices, and across organisations? Most notable within these challenges is how to further deliver seamless interaction with the Crown Prosecution Service and legal representatives? How can we demonstrate an end-to-end chain of evidence across the system (e.g., using blockchain technology)? The challenges here are diverse because the forms of information and types of queries vary across needs. Nevertheless, today's workforce expects connectivity to be as easy and as seamless as they experience outside of work, and so this is what we strive for.

Modern, full-journey public engagement

How can we better service the public and victims so that they have easy and timely access to information? Our interests here relate to possible 'self-service' options that provide assurance to victims on their case progress, to learning from customer-centric organisations and how they mitigate issues such as uncertainty of service delivery. This interest is not about reducing the person contact the pubic have with the police workforce, but being able to use that contact is a smarter, more effective way. This may include the use of smart assistants that could help manage the logistics of police deployment and tasking, as well as ensuring that victims and witnesses receive the best possible support.

Next steps

We welcome your engagement with our ARIs in the following ways:

- If you have evidence that completely or partly supports or answers one of our ARIs, we invite you to share that with us. For any ongoing research relevant to policing and crime reduction, we encourage you to register your research on the College of Policing's research projects map, which has been designed to promote collaboration and support requests for participants.
- If you are, or plan to be, carrying out research that relates to one of our ARIs, we'd like to hear about it. While we cannot respond to speculative approaches for research funding, we will where possible act to support your ambitions, including finding you policing partners where possible.
- If you are submitting a funding or grant application that aligns with one of our ARIs, we hope that referencing policing's ARIs will help to strengthen your case for the possible public impact of the research.
- We will use the ARI document to structure our academic engagement, prioritise events and build new connections with external partners. We will be using our ARIs in our engagement with UKRI, and we will publish any opportunities for funding via our website:

science.police.uk

Please send any correspondence and questions to csa@npcc.police.uk, including 'ARI' in the subject heading.

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