Institution: University of Gloucestershire

Unit of Assessment: UoA 04, Psychology, Psychiatry and Neuroscience

1. Unit context and structure, research and impact strategy

Overview

UoA 4 within the University of Gloucestershire was not entered into the last REF. As a newly formed UoA, the strategy to date has been to fully embed research in already mature structures centred around undergraduate and taught postgraduate teaching.

Over the period of the current REF, support and resourcing has been put in place, both at Unit and University level, to facilitate the rapid development of the UoA. This investment has been highly successful, to the extent that the intention is to submit 12 FTE staff into the 2021 exercise. These twelve staff are: Baker, Edgar, Kantartzis, Murray, Pompedda, Rees, Sandham, Schenke, Sitch, Stephens-Lewis, Sumner & Wheatcroft.

UoA 04 within the University hosts the Centre for Research in Applied Cognition, Knowledge, Learning, and Emotion (CRACKLE), and the Health, Environment Responsibility & Action (HERA) laboratory. The Forensic Research Group (FRG) has also recently launched within the UoA.

Within the University of Gloucestershire, UoA 4 is under the umbrella of the Research Priority Area (RPA) of Health, Life Sciences, Sport and Wellbeing (HLSSW) that provides oversight across a number of UoAs and facilitates cross-disciplinary research. The RPA also provides a conduit for the distribution of University research funding.

As a new UoA, many of the staff forming the Unit are early career researchers. Nine of the Unit staff took up their first academic post within the past six years. The strategy for research development within UoA 4 has been focused on inclusivity and embedding research within the fabric of the Unit. All staff (including support staff) and students (undergraduate and postgraduate) within the Psychology Department are encouraged to fully engage with research. Strong synergies between teaching and research have been developed and research is integrated into teaching at all levels using both formal and informal approaches. For example, all students (undergraduate and postgraduate) are encouraged to engage with staff research. Research projects form a part of the curriculum that extend far beyond, for example, third year dissertation research. Students can volunteer to assist with research projects and this has been formalised into a Research Apprenticeship scheme. Students can undertake an internship module that allows them to gain research experience as a formal part of their degree; and they can also apply for funded research-assistantship posts as part of ongoing research programs.

The research culture is supported by regular research seminars to which all staff and students are invited. On a more informal level the Unit holds regular ‘research cafes’ (actual or virtual depending on circumstances) where staff and students can meet to discuss all aspects of research within the Unit, together with a paper-writing club to support all (particularly early career) staff. This inclusive approach has been enthusiastically embraced by both staff and students, to the extent that undergraduate students have been involved in internationally collaborative research projects (such as the Firemind project described below). Input from students and support staff into Unit research has been of sufficient significance for both to be included as authors on papers published in peer-reviewed journals.

Postgraduate research is a growth area within the Unit, and is a priority for the strategic direction of the Unit. As a first step, funding has been made available for MScs by research. As the Unit matures, the aim is to expand the doctoral research program within the Unit, supported by the increasing success of members of the Unit in attracting research funding (see Section 3).

As a new UoA, the research strategy has been to recruit staff within research areas that form a number of coherent themes that can be well supported in terms of infrastructure and facilities (see Section 3). The overarching theme for all research within the Unit is to conduct applied research, researching issues in real-world environments, but with a strong theoretical underpinning. Such an approach allows for clear links with the wider economy and society (see below) and not only increases the utility and impact of the Unit research, but also facilitates access to a greater range of possible funding sources.

Within this overarching theme, the UoA has three nodes of research activity, and there are strong links between nodes. These nodes are as follows:

A. Applied Cognition and Neuroscience.

This node is built around the Centre for Research in Applied Cognition, Knowledge, Learning and Emotion (CRACKLE). The Cognition and Neuroscience node focuses on how individuals and teams use available information (from technological and social systems) to build situation awareness (SA) – ideally, a knowledge of what is happening in the situation in order to drive an appropriate response. Almost uniquely, this group study SA from the perspective of the underpinning neuroscience, through individual cognitive processes, to overarching social influences – and beyond to examining whether neural networks can be used to understand and interpret the actions of these processes.

The research of Edgar and Baker is concerned with the modelling and measurement of situation awareness and the development of a novel tool (QASA – Quantitative Analysis of Situation Awareness) that contains measures that give unique insights into SA. This tool was originally developed in a military context but has now been extended to use in other domains, such as health, and firefighting. This research has demonstrated, for example, that firefighters use information in different ways when building SA, and that these differences may have a cultural element. This work has been supported by grants from the UK MoD, and the European Union Erasmus+ scheme. The team have strong links to fire and rescue services across Europe and also to the UK NHS - and the team have investigated implementing lessons learned from measuring firefighters' SA in obstetric training. For example, in obstetric monitoring, perceived SA was found to often not match actual SA, to the extent that some individuals believed they had carried out essential points of procedure when they had not. The research linking SA with underpinning neuroscience is also the basis of a link with the School of Engineering & Technology within UoG, that has successfully obtained funding (from the MoD – see Section 3) to examine whether neural networks can be used to identify EEG patterns that indicate changes in SA. The QASA research underpins Impact Case Study 1 within this UoA.

The applied SA work within the unit is almost unique worldwide in that it is underpinned by neuroscientific investigation and theory development and one of the outputs submitted is one of the first papers in the world to successfully link EEG markers with changes in SA.

Schenke, as a social neuroscientist whose research centres on social interactions with a particular focus on predictive social perception, has facilitated a broadening of the SA research to look at team SA. In the first instance, the research team (Baker, Edgar, Rees, Sandham, Schenke) have successfully obtained an internal grant to provide the first test of whether information from a team is encoded in a person-specific manner, and the influence that this

process may have on overall SA. This development of the SA model should then provide a basis for external funding applications to explore this person-specific SA in more applied settings such as in sports teams, the MoD and the emergency services.

Researchers in this node are also engaged in fundamental research into cognitive processes. Druey has studied mental-set shifting in young adults and Kantartzis' research is concerned with the facilitation of learning by sound symbolism in infants.

Murray has conducted extensive research into face recognition skills that links into all the research within this node, such as the work of Baker examining somatic markers ('gut feelings') in response to subliminally presented emotional faces, and also to aspects of threat-detection and eye witness testimony that links to the Forensic Psychology node.

B. Health, Wellbeing and Development.

At the centre of this node is the HERA (Health, Environmental Responsibilty & Action) Lab. This node has interlinked research into the physical, mental, and environmental aspects of wellbeing. Three central strands sit within this node:

1) (Un)employment and health.
2) Social prescribing.
3) Reciprocal benefits in human-nature interactions.

Within the first strand, Sumner's research is concerned with the immunological and endocrinological consequences of (un)employment – and has demonstrated that the relationship between unemployment and chronic stress is nuanced. This work has resulted in four published papers (including a systematic review). This work is helping to develop the field of the chronic stress of unemployment by advancing knowledge, improving existing methodologies, and broadening the conceptual frameworks of the "employed versus unemployed" discourse to account for more contemporary elements of the working world, such as the gig economy and zero-hours contracts. Further to this, Sumner has recently started an international collaboration looking at the welfare of frontline workers in the pandemic, developing future models of burnout in these critical workers that will be the subject of future submissions.

In the second strand, Sitch's research focuses on the impact of physical activity on wellbeing in a variety of contexts and complements Sumner's research. Sumner and Sitch have carried out an evaluation of the first ever nature-based intervention for secondary health care (cardiac rehabilitation) patients commissioned by the Gloucestershire Wildlife Trust and Gloucestershire CCG. Rees's research (in collaboration with both internal and external collaborators) is concerned with the psychological health and well-being of both clinical populations and the associated carers. Rees has, for example, strong links with the 2gether NHS Trust and is collecting data on predicting the psychological well-being of paid carers. This work is, as yet, unpublished but has been presented at conferences, such as the Faculty for People with Intellectual Disabilities Annual Conference, 2015. A second project in collaboration with the 2gether NHS trust and the University of South Wales has evaluated the Health Equalities Framework (HEF) measure and work is ongoing to develop a training tool to evaluate and improve inter-rater reliability within this measure.

Rees also conducts research into interventions targeted at improving the mental wellbeing of dementia suffers. This work, funded by a small grant, includes an evaluation of the efficacy of 'walking rugby' for improving wellbeing in dementia suffers, in association with Gloucester RFC. A small grant from a lottery-funded project (Drumming together) is also evaluating the effect on the psychological wellbeing of dementia sufferers as a result of their taking part in drumming sessions that facilitate co-ordination and turn-taking. Rees and Kantartzis are collaborating with Gloucestershire Health and Well Being Trust examining the effect of body ideals perpetuated within mainstream and social media.

Environmental influences on wellbeing are the focus of research led by Sumner evaluating the efficacy and acceptability of Social Prescribing interventions in Primary Care. This project is a longstanding collaboration with the Gloucestershire Clinical Commissioning Group, and has been supported with internal funding and external consultancy commissioning. Cross-discipline collaboration is key to this project and the project underpins an impact case study within UoA 24 (Sport, Exercise, Leisure, Tourism). This project involves using the largest Arts on Prescription (prescribing art courses with the aim of improving wellbeing) dataset to date, quantitatively examining wellbeing impact in the cohort as a whole, and within special subpopulations such as those with multimorbidities. This work has also been extended to look at factors associated with population attendance, engagement, and wellbeing outcome for the first time in such an intervention. Further, this work has been extended with the support of internal funding to incorporate understanding of how interactions with nature support health and wellbeing. Sumner has also undertaken commissioned evaluations of nature- and arts-based interventions in the form of Mindful Photography, as well as evaluations of integrated and multi-disciplinary health interventions for Macmillan Cancer Support.

The final strand involves the development of work to better understand the reciprocal benefit between humans and our natural world led by Sumner and involving collaborations with Cardiff Metropolitan University and University College Cork, as well as collaborations with Applied Ecology at UoG. This work involves theoretical work to explore the nuances of benefits garnered from interacting with nature, and to resolve issues around previous work that has been unable to form consistent findings. Within this strand, Sumner has started research to test this theory, focusing on the use of cortisol to understand the stress reduction capacity of interacting with nature. A fundamental underpinning of this research is that it does not come at a cost to nature, and so elements of sustainability, conservation, and ethics are embedded within the research. Such an approach is entirely consistent with the goal of the University of Gloucestershire to be a sustainable university, as evidenced by the shortlisting of the University for three entries in the UK Green Gown Awards 2020.

This work on human-nature interaction has been extended with the support of internal funding to incorporate understanding of how interactions with nature support health and wellbeing. Sumner has won external funding from the BA Leverhulme Trust for a study examining the capacity for virtual nature to reduce biochemical markers of stress (cortisol and DHEAS), although this is currently on hold due to the pandemic. Sumner and Sitch have carried out an evaluation of the first ever nature-based intervention for secondary health care (cardiac rehabilitation) patients commissioned by the Gloucestershire Wildlife Trust and Gloucestershire CCG. Sumner has also undertaken commissioned evaluations of nature- and arts-based interventions in the form of Mindful Photography, as well as evaluations of integrated and multi-disciplinary health interventions for Macmillan Cancer Support.

C. Forensic psychology.

The Unit has an active research team in the area of Forensic Psychology, built around the newly-formed Forensic Research Group (FRG). The purpose of the FRG is to galvanise and further strengthen teams, staff and students to create a sense of belonging, shared vision and culture around research, adding to, and complementing, the research environment. The goal is to become a recognised centre of excellence in the application of Psychology to Forensic domains.

There are obvious strengths that submitted staffs brings to the group; (i) investigative interviewing, (ii) legal and courtroom psychology, (iii) eyewitness memory, (iv) detecting deception, and (v) prison (and probation) psychology. There is also real potential to develop related Virtual Reality (VR) environments and collaborative endeavour across the aforementioned groups and disciplines more widely. Indeed, the FRG are working closely with the University of Lincoln in developing a VR courtroom environment. Recent appointments are contributing to developing critical mass within the FRG, but in order to maintain the strategy the domain will also focus on identifying, retaining, training and mentoring staff to develop their research potential. Moreover, the research team will look more widely across the University, and externally, to develop multi-disciplinary approaches to funding bids.

During the current REF period, there have been significant developments that are worth noting. Wheatcroft has made a significant contribution as a psychologist working closely with the Inns of Court College (ICCA) in the development of the 20 Principles of Questioning (see UoA 4 Impact Case Study 2). The principles resolve problematic questioning in the legal context. Wheatcroft's research underpins ICS 2, which centres on the impact of using directive-leading questions in legal processes, particularly as applied to those involving children and vulnerable witnesses. The research, some supported by the Arts and Humanities Research Council (AHRC), has contributed to the 20 Principles underpinning the Advocacy and Vulnerable National Training Programme delivered by the Inns of Court College of Advocacy (ICCA) to over 14,000 criminal advocates - a significant undertaking. The 20 Principles, in addition to adaptations for the Family Law Bar Association (FLBA), the Civil Justice Council, and the Northern Ireland Bar, underpin training that has international reach (e.g., Caribbean, India and parts of Australia). It is likely that impact will continue to the next REF cycle as the Principles flex and expand. Wheatcroft also has interests in aspects of situation awareness, that link directly with the Cognition and Applied Neuroscience node.

Other projects have provided the evidence base for operational change, such as research informing security in airports (Sandham), and in supporting training for investigators using avatars (Pompedda). Pompedda's research is particularly concerned with improving the interviews of victims of alleged child sexual abuse and uses avatars equipped with response algorithms and predefined memories to facilitate the training of interviewers to ask appropriate and useful questions. Pompedda's research also dovetails with that of Stephens-Lewis who has interests in the examination of factors (e.g., particularly drugs-of-abuse) involved in intimate partner violence (IPV).

Interviewing is also one of the areas of research for Sandham, although her research moves beyond the interview process to also examine the determination of truth and deception more

generally. As such, the research is primarily focused on the processes underpinning investigative reasoning and detecting deception. For example, using a computer mediated questionnaire within an insider-threat scenario as a tool to a) obtain a rapid "version of the truth" after an insider attack incident and b) as the basis for use in triage when investigators determine the priority of employees for interviewing.

In addition to Wheatcroft, Sandham's research also links with the Cognition and Applied Neuroscience node and Sandham is developing links with the School of Engineering & Technology at the University of Gloucestershire to continue her previous work looking at the investigative reasoning process within digital forensic investigations. The aim is to develop some pilot work that she has already carried out in collaboration with a former colleague at De Montfort University concentrating particularly on confirmation bias. Stronger links with Engineering and Technology are being forged across the UoA as Engineering and Technology have expertise in neural networks that have been the basis of a successful funding bid to link situation awareness, EEG and neural networks.

Some submitted staff of the FRG are also members of an International Eyewitness Research Programme.

2. People

A. Staffing strategy and staff development

The Unit is led by a Professor of Psychology and Applied Neuroscience (Edgar). There is a second professor within the unit (Wheatcroft), and one emeritus professor (Catherwood) associated with it. As the Unit was not entered into the last REF policies have been put in place to develop the research culture within the Unit. There has been a clear goal of employing staff whose research interests complement and strengthen the core themes of the Unit. The Unit research-lead (Edgar) has been a member of most recent job shortlisting and interview panels. Recruitment policy has been to build around the core themes by appointing primarily early-career researchers to vacant posts and to then support, and invest in, their development.

To this end, UoA 04 has established an 'Early Career Researcher Network' (ECRN) that has subsequently been rolled-out across the university and is now approaching100 members. The ECRN activities complement the University's existing peer mentor scheme, providing all staff with the opportunity to develop the various strands of their academic work, no matter what their career stage. The ECRN aims to provide collegiate support for early-career researchers in the form of advice, information, and meetings – both social and academic.

The funding stream through the University Research Priority Area (RPA) is also targeted at early-career researchers in the form of a rolling small-grants program and the majority of early career researchers within the UoA have been a recipient of at least one of these grants. Although experienced researchers can be included in the projects, a key criterion is that the project should demonstrate the potential for the development of an early-career researcher to enable them to develop and maintain research activity.

The development of early career researchers is a key element of the overall research strategy within the unit, particularly as the unit has recruited further early career researchers (after the cut-off for the current REF), potentially increasing the size of the UoA to 16.

Development of research capability is a key element of development for all staff with the overall aim being to support senior researchers to increase the breadth and reach of their research and to also ensure that there is a clear progression route for early career researchers to become senior researchers. All staff have an annual 'Staff Review of Development' (SRD) that includes a discussion of research aspirations. The RPA funding also includes initiatives that are directed at supporting research for all staff at all stages of their career, and these include:

- Funding to facilitate collaborative research across UoAs.
- 'Rapid response' grants to pump-prime bidding for external funding.
- Funding for senior researchers within the UoA to facilitate the development of internationalisation strategies.
- Funding to support dissemination of research.
- Two-day writing retreats are available to all Unit staff, allowing a protected time away from the university in which to write research papers.

Informal grant writing support is available via the regular Unit meetings. All staff are supported in research funding bids by senior staff within the UoA, and external to the UoA by the University Funding Office that provides a central repository of knowledge and expertise related to writing and submitting funding bids. This support is directed particularly at supporting larger bids and the UoA has had significant successes in attracting larger grants (see Section 3).

B. Research students

In the period covered by the current REF, there have been eight PhD completions.

The UoA is aiming to build its graduate profile, particularly in the area of doctoral students. As outlined in Part 1, there has been a deliberate attempt to embed research at all levels within the UoA and, so far, this has been very successful in generating research interest and involvement amongst undergraduates and taught-MSc students. The strategic direction for the research strategy is to 'roll-on' this inclusive approach to postgraduate research.

To this end, internal funding has been made available to support scholarships associated with high-impact research within the unit. These scholarships (two per year within the unit) will be used to facilitate students undertaking postgraduate research (MSc by research).

There is an active doctoral research programme within the Unit and the strategy is to grow this area organically through the increasing experience of research staff generating increased research income and so 'rolling through' research involvement from undergraduate to MSc (taught and research) to PhD. In effect, the research strategy is to develop a research 'pipeline' that will allow both staff and students to develop as part of an active and inclusive research culture.

This strategy has already achieved demonstrable success. The current Academic Course Leader for the psychology offering within the Unit (Baker) was originally an undergraduate within the University. Baker became involved in research at the undergraduate level, stayed on to do a PhD funded by the university, a post-doc funded by the Firemind project (that forms a part of the Unit Impact Case Study), and then successfully applied to join the Unit as a full-time member of staff. An increasing number of undergraduates are now expressing an interest in continuing to postgraduate research (both at masters and doctoral level), and registrations for PhDs are increasing.

3. Income, infrastructure and facilities

Research income

Senior researchers within the UoA (Edgar, Catherwood, Wheatcroft) have been successful in attracting large grants that have been used to establish facilities and seed research within the UoA. The current EEG facility (described below) was originally established using a grant of £247,595 won under the MoD Competition of Ideas in 2008. Although this income falls outside the period for the current REF, it was instrumental in building the research infrastructure of the UoA, to the extent that the facility formed a part of a successful collaborative bid (with the School of Engineering & Technology) that in 2019 won £99,913 in funding, also from the Mod – a project that involves a wide range of staff (Baker, Edgar, Pompedda, Rees, Sandham, Schenke, Wheatcroft).

The emphasis on applied research within the Unit is evident in successful bids into the EU Erasmus+ scheme that has funded two pan-European collaborative projects: €260,074 in 2014 for the Firemind project and €361,405 for Firefront. Both projects are developing measures and methods for training decision-making in firefighters.

Although the large grants within the UoA have been obtained by the senior researchers, the strategy within the UoA is that all staff should be encouraged to bid for funding and this is a strategy that is proving successful within the timeframe of the current REF. As described in Section 1, less experienced researchers can bid for internal university funding, providing experience of writing and submitting bids. This approach has successfully transferred to bidding for external funding, where UoA researchers are increasingly successful in winning (initially) small externally-funded grants.

For example, Sumner has successfully won a BA Leverhulme small grant for £8,145 and other small grants and consultancy income totalling £18,000, and has been awarded a further £11,000 in internal Quality Related Strategic Priorities Funding. Staff are also encouraged to engage in consultancy activities, and this is providing a growing source of income (almost £30K to date) to the UoA. Over the REF period the total research income for the UoA is £242K. The successful development of the UoA is evidenced by the fact that not only are early career researchers becoming principal investigators on research projects (e.g. Sumner, as outlined above) but over 65% of the UoA research income been won in the last two years of the current REF period. Both the amount of funding, and number of staff involved in obtaining that funding is increasing.

Research facilities.

The unit has access to a wide range of dedicated research facilities. These facilities have been funded by internal university funding and external grant income. The facilities are available for use by all staff and students within the Unit, although they have been developed to particularly support the three research nodes described in Section 1 as follows:

A. Applied Cognition and Neuroscience Facilities.

Dedicated laboratory space is at the centre of the facilities underpinning this node. The keystone of the facility is an electroencephalography (EEG) facility equipped with state-of-the-art 128-channel dense-array EEG, eye-tracking & other psychophysiological apparatus (e.g. electrodermal activity). The facility was originally established by a grant through an MoD 'Competition of Ideas' to Edgar, and has been used to attract further MoD funding that has been used to drive cross-faculty collaborative research with the School of Engineering & Technology (see above).

The Unit also has an experimental psychology laboratory that is a dedicated and specialised research space for staff and student research. The laboratory contains a suite of Windows PCs (each including the standard Microsoft Office suite, Adobe Creative Suite for digital video/audio editing, plus SPSS and web browsing capability) which are configured to support advanced hardware functions, including physiological measuring equipment (BIOPAC), experiment generation software with millisecond accurate response recording (E-Prime), MATLAB programming platform, and Virtual Reality (VR) & Augmented Reality technology that includes 3 x Oculus Rift CV 1, 1 x Oculus Rift DK2, 1 x Microsoft Hololens and 2 x HTC Vive with room tracking capabilities, 3 x Oculus Quest for portable use and a Freedom360 rig and HTC GoPro Fusion camera recording digital 360° spherical videos (for use with VR headsets).

These facilities, while central to the Applied Cognition and Neuroscience Node, are also freely available to support the other nodes. For example, the VR facility has been used to explore the beneficial effects of exercise, aspects of eye witness testimony, and the efficacy of 'assistance dogs' in facilitating learning – areas that are part of the other two nodes described in Section 1.

Even before the COVID-19 challenges, the Unit has been investing in developing on-line experimental platforms that have been of great benefit in expanding the experimental capabilities of the unit. Experimental research is no longer tied to physical facilities within the university, making it much more accessible to staff, students, and external organisations. For example, online facilities have been developed that allow training protocols to be implemented with firefighters across Europe as a part of the Firefront project (see above) and to also collect data that will form a part of the research within the Unit.

B. Health, Wellbeing and Development Facilities.

The facilities underpinning this node have been established to provide physiological and psychobiological measures that can complement other measures of wellbeing (such as interviews and questionnaires).

The Unit has facilities for collecting and analysing psychobiological markers including the HemoCue WBC DIFF system (for white blood cell counts), and the ELISA Assay system that can be used to assess, for example, levels of stress hormones such as cortisol.

The strategy of developing applied research also drives facility development, with an emphasis on wearable and portable technology such as hand-held devices for measuring electrodermal activity, wearable heart monitors for measuring markers such as heart-rate variability (HRV – often used to assess workload), and ambulatory EEG systems (Emotiv).

These wearable systems are fully complemented by, and integrated with, the laboratory-based systems (such as the 128 channel EEG) described under the Applied Cognition and Neuroscience node. For example, once EEG markers of changes in situation awareness have been identified in the laboratory, these same markers can be sought in more ecologically valid situations. The ambulatory HRV monitors have also been used with VR part-task cycling simulator, and alongside biochemical assessments of stress hormones from saliva.

Aa another example of the use of these systems in applied research, the hand-held electrodermal activity monitors have been used in schools to assess stress levels in children that are taking part in animal-assisted learning schemes. Not only is it unnecessary for children to come into the laboratories; as the monitors are held between finger and thumb, if a child feels in any way uncomfortable with the device, they can simply drop it.

C. Forensic Psychology Facilities.

At the centre of the facilities underpinning the Forensic psychology node is the crime scene facility. The UoA has access to a house dedicated to the simulation of crime scenes (in living room, kitchen or bedroom). The house is reconfigurable for a range of crime scenes and all areas are covered by CCTV and sound recording equipment. The facility can also be used to set up scenarios for testing situation awareness in domestic firefighting or arson scenarios, providing links with the Applied Cognition and Neuroscience node.

The UoA also has access to a Forensic Interviewing Suite comprises two rooms, an interview room and a recording room. These two rooms are fully enclosed with doors, independent lighting and provide a controlled space for the observation and recording of interviews. Video recording of interviews is achieved with the use of a 3-way CCTV system with 360° audio recording from ceiling microphones. The rooms are linked with a two-way mirror.

D. General facilities

Although all facilities within the UoA have been established to be as widely used as possible, there are some underpinning facilties that have been developed to support all nodes. For example, the UoA has state-of-the art portable calibration equipment, that can be used for the calibration and standardisation of displays both within laboratories and elsewhere. The equipment can also be used for the quantification of physical stimuli (e.g. clothing) used in, for example, studies into eyewitness testimony and can also measure lighting levels for studies in wellbeing and in the crime scene facility.

4. Collaboration and contribution to the research base, economy and society

Staff within the unit collaborate widely across the university and, externally, collaborate nationally and internationally with universities (including collaborations with numerous universities external to the UK), consultancies and public bodies such as the NHS.

Research within the unit is geared towards wide application based around a strong theoretical core. Such an approach is geared towards a synergistic two-way interaction with local, national and international collaborators.

For example, one of the key strands of the Applied Cognition research area is an approach to measuring 'situation awareness' that is strongly rooted in cognitive psychology and neuroscience. The research was originally developed by one of the senior researchers (Edgar) in the unit while working in industry (BAe Systems) and was brought into the unit when Edgar joined the University in 2002. This research has now been developed into a highly effective, and theoretically sound, approach for measuring situation awareness in applied contexts that is in increasing use worldwide. The approach, referred to as 'Quantitative Assessment of Situation Awareness' (QASA) was originally developed in the military domain, but has now been applied in the health, driving and firefighting domains.

In particular, the application in the firefighting domain has been particularly successful within the Firemind and Firefront projects that have led to highly successful collaborations (led by Edgar, Catherwood and Baker) across Europe. The flow of information is two-directional. The Firemind/Firefront approach is informing training in several European countries and has been formally incorporated into the national training program of the Netherlands. Other collaborations have been established as a result of the Firemind and Firefront projects. Edgar, Catherwood, and Baker have developed collaborations with Falck (Denmark); Instituut Fysieke Veiligheid (IFV Brandweeracademie, Netherlands); Centrum Naukowo-Badawcze Ochrony Preciwpozarowej Im.Jozefa Tuliszkowskiego – Panstwowy Instytut Badawczy (CNBOP-PIB, Poland); Provincial Centre for Education and Training (PLOT, Belgium); University College Copenhagen (Denmark); Estonian Academy of Security Services (EASS, Sisekaitseakadeemia, Estonia); Institute for Public Security of Catalonia (ISPC, Institut de Seguretat Public de Catalunya, Spain).

These collaborations have also been instrumental in the theoretical development of the QASA methodology, with firefighters and researchers from all project partners actively engaging with the development of the tool. For example, the earliest collaboration with firefighters was with Gloucestershire Fire and Rescue Service (GFRS). The then Deputy Chief of the GFRS embarked on a part-time PhD as a part of the collaboration and is now continuing post-doctoral research as a part of the latest incarnation of the Firemind project, Firefront. An author on one of the key theoretical papers underpinning the QASA approach is a firefighter within IFV Brandweeracademie, Netherlands. Members of the Unit (Baker, Edgar, Sandham, Schenke) are also developing strong links with Leicestershire Fire and Rescue Service that are the UK lead in developing training and public information facilities within virtual reality (VR).

The Health, Wellbeing and Development research area has developed active collaboration with health trusts, universities, and related organisations both locally and nationally. For example, members of the unit are heavily involved in the Research4Gloucestershire collaboration. This initiative drives a formal, strategic research relationship with the University and the health and social care organisations within the county. A Statement of Intent agreement was formally signed by all signatories in June 2017.Signatories include the University, Gloucestershire County Council (both the leads for Public Health and Social Services), Gloucestershire Clinical Commissioning Group, Gloucestershire Care Services NHS Trust. The Statement of Intent identified the need for joint working in the development and dissemination of research, and both

supports and facilitates partnership working between participating organisations through shared resources, the pursuit of joint appointments, the development of bidding teams, and research output. Staff within the Unit also have active collaborations with the Worcestershire Acute Hospitals NHS Trust and Worcestershire University to understand the psychological impact of anaphylaxis. This work forms the basis of an impact case study within another UoA.

Members of the Unit (led by Sumner) have contributed to a POST review on the 'Mental health impacts of COVID-19 on NHS healtchare staff' (https://post.parliament.uk/mental-health-impacts-of-covid-19-on-nhs-healthcare-staff/) which will be delivered to parliament. The unit's research has also been incorporated into an All Party Parliamentary Group report, presented to parliament, and has recently been used as part of a combined review report for the WHO. Further, Sumner has also contributed to a report for the United Nations Population Fund on the Madrid International Plan of Ageing.

The Unit is also developing strong links with charities and volunteer organisations, such as Headway, Macmillan Cancer Support, Gloucestershire Wildlife Trust, The Independence Trust, Dogs Trust, Riding for the Disabled, Artlift, Look Again, Forestry England, and Gloucestershire Local Nature Partnership. These links with organisations external to the University are being developed to both provide benefits to wider society and also to provide opportunities for student research placements, further embedding research and collaboration at all levels within the Unit. These tangible benefits to society have been demonstrated by initiatives such as the 'Drumming Together' project (led by Rees) that, for carers in West Bromwich, uses drumming as a therapeutic intervention and the basis for beneficial social interaction.

Within the Forensic node, the Forensic Research Group (FRG) has a number of partnerships. For example, Wheatcroft continues working with the Inns of Court College of Advocacy in respect of the work related to the 20 Principles. In addition, Wheatcroft is a consultant on the ICCS Child & Advocacy Working Party, which is currently developing new materials for a further training programme for legal practitioners working in the Youth Courts – although the course is in early development, the training will incorporate adaptations of the 20 Principles for working with young people. Whilst this work is ongoing, it is expected that the adaptations of the 20 Principles for use in the Youth Courts will provide evidence of further expansion of the UoA 4 Impact Case Study 2.

Wheatcroft also works closely with academic colleagues at the Norwegian University of Science and Technology (NTNU). Together with affiliated companies (in Norway, via Project Norway, and in the UK) Wheatcroft is applying psychological and forensic principles to construction management. As noted, the FRG are working with the University of Lincoln in developing a VR courtroom environment which is to provide the pilot and groundwork for larger funding bids.

Further research that has a potentially strong societal impact is that led by Pompedda; investigating the use of avatars for training investigative interviewers in alleged child sexual abuse cases. This work is conducted in collaboration with organisations in Japan, China, and Estonia.

Moreover, the FRG has established research and training links with policing (e.g., West Mercia, Merseyside, Greater Manchester), victim support (e.g., Birmingham) and legal organisations (e.g., ICCA), prison - and making further links with probation services. More widely, the group

has links with Government agencies and the United Nations; Wheatcroft is also interview advisor to the Foreign & Commonwealth Office (FCO).

The Unit strategy of inclusivity in research at all levels is also evident in outreach activities. The Unit has research projects running in schools (led by Rees) and also invites students from local schools to come into the university for 'research days' during which they have the opportunity to engage with a wide range research staff. Members of the unit also regularly feature in local and national media.

Members of the unit (Baker, Edgar, Rees, Sandham, Wheatcroft) have strong links with consultancies (K Sharpe, MacMillan, User Perspective) within the area of Human Factors and these collaborations are being used to develop further bids into, for example, the Ministry of Defence (MoD).

Staff are regularly involved in outreach activities, presenting topical research in public lectures and in the local and national press (e.g.: https://www.theguardian.com/lifeandstyle/2020/may/26/people-were-like-animals-how-supermarket-staff-watched-coronavirus-crisis-unfold) – and making links with local organisations (e.g. Slimbridge Wildlife ad Wetlands Trust, Headway, U3A). Moreover, staff have been engaging with the wider community in embedding evaluation frameworks into community enhancement projects such as the Compassionate Stroud project, that is seeking to create an entirely new social and community health and wellbeing network in the area to support the health of the community. Staff also serve on external committees. For example, Wheatcroft is Chair of the British Psychological Society (BPS) Division of Forensic Psychology Training Committee and Sumner represents the University as part of the Gloucestershire Local Nature Partnership.