Institution: University of Sheffield

Unit of Assessment: 4 – Psychology, Psychiatry and Neuroscience

a. Overview

Since RAE2008, the University of Sheffield has built on its international reputation for research leadership in psychology, psychiatry and neuroscience. This has included 21 new appointments and securing substantial investment in infrastructure. Our strategy has been to foster an inclusive, ambitious vision for behavioural science that focuses on a scholarly commitment to cutting-edge and collaborative research. We believe the vigorous and dedicated research environment that we have built stands testament to the success of this strategy. We benefit from exceptional expertise that covers the full range of methodologies in behavioural science: in-vivo, in-vitro, computational, cognitive and clinical neuroscience, and experimental, social, developmental and clinical psychology and psychiatry. Research is structured around six groups: Systems Neuroscience, Computational Neuroscience and Robotics, Clinical Neuroscience and Psychiatry, Developmental Psychology, Clinical Psychology, and Social, Health and Environmental Psychology. Collaboration is strong within and between groups in the UoA, with cross-cutting collaborations across the wider university (e.g., in the Sheffield Centre for Robotics [SCentRo], the Centre for Psychological Services Research [CPSR], and the Centre for Assistive Technology and Connected Healthcare [CATCH]), and nationally and internationally (32% of papers include international collaboration).

The vitality of this diverse, yet highly integrated environment is demonstrated by the range of our outputs, awards and activities. We were ranked 7th in the UK for research income in the ESRC's 2011 Psychology International Benchmarking exercise. We have received more than £9.7M in external funding during the REF period. EU funding has been a particular focus (>£3M, a 354% increase on RAE2008 A44 return). This funding has enabled contributions to large-scale research projects, such as the development of world-leading robotic platforms, in collaboration with international centres of excellence. Our outputs include 700 papers with 5235 citations (mean per output = 7.48), 16 books and 72 book chapters. We have hosted independent research fellows with funding from sources including ESRC, EPSRC, Royal Society and the NIHR Clinical Lecturer Scheme. Two new fellows will start shortly with EPSRC and ESRC Future Leader funding. We have housed the Presidents of the European Health Psychology Society, the European Association for Mental Health in Intellectual Disabilities and the Human Factors and Ergonomics Society European Chapter, as well as five Academicians of the Academy of Social Sciences during the REF period. Currently, our staff hold 20 learned society fellowships, including nine BPS fellowships. Our staff have won the highest honours in the field, including the 2013 BPS Social Psychology mid-career award and the 2012 MB Shapiro Award for lifetime contribution to clinical psychology. We have a commitment to capacity building and are very much looking to the future: We have secured £5M investment in new neuroscience laboratory infrastructure, with new facilities coming on line in 2012 and 2014. The university has committed a further £15–20M of infrastructure investment to provide state-of-the-art accommodation for our other research groups. We believe we are strongly positioned to embrace the challenges facing contemporary science and society.

b. Research strategy

Our vision is to enrich and enhance our status as one of the leading global centres for behavioural science research and knowledge transfer in order to improve health and wellbeing in society. Two overarching objectives define our strategy:

(1) To develop capacity within research groups while enhancing cross-disciplinary collaboration. To this end, we have made 21 appointments since 2008, targeted to complement existing expertise. For example, our social and health group contained skills in behaviour change relating to health (Sheeran, Norman, Webb) and organisations (Totterdell). The appointments of C Jones and Crisp brought further experience and new perspectives in behaviour change related to environmental behaviour and prejudice respectively. For instance, Crisp recently set out a new cross-disciplinary agenda on multiculturalism in the journal *Science,* combining evolutionary psychology, neuroscience and behaviour change. These new appointments allow the group to address all major areas of contemporary behaviour change research. As we believe that many future

advances will emerge from cross-disciplinary integration, we have also purposely appointed in areas that develop links between approaches. For example, the appointments of Levita, Howarth and C Martin enhance links between animal and human neuroimaging. Millings, jointly appointed with CATCH, links social psychology with computational neuroscience through research addressing attachment to robotic companions.

(2) To realise the societal relevance of our research while maintaining the quality of fundamental science. In response to funder priorities, we have intensified our focus on applied work and its translation to non-academic impact (see REF3). For example, as described below, work addressing animal neuroimaging may revolutionise human epilepsy treatment; bench robotics is helping an ageing population to live independently for longer; our behaviour change research is informing lifestyle choice interventions; and multi-level modelling of large-scale health service datasets is improving delivery of psychological therapies.

Strategic Achievements since RAE2008 and Aims for 2014–19

Consistent with our RAE2008 aims, the neuroscience group returned in A44 has grown into two large, yet distinctive groups. In **Systems Neuroscience**, fundamental work on neurovascular coupling has continued and its societal relevance has been strengthened with the development of animal models of human epilepsy that potentially translate into presurgical diagnostic approaches for neurosurgeons. Research addressing the role of the basal ganglia in action selection has expanded with a cross-disciplinary focus, now encompassing computational (Gurney), electrophysiological and pharmacological (Redgrave, Overton, Bracci) techniques. Supported by these successes, the group relocated to new laboratories (2012), including a new 7T small bore magnet for animal research, representing a £2M university investment. Over the next five years the group will capitalise on newly appointed intracellular (Bracci) and awake animal (C Martin) expertise to extend multi-disciplinary work. The group plans to maintain capacity for cutting-edge research by acquiring critical, recently developed in-vivo voltammetry and 2-photon imaging microscopy technologies, to complement Bracci's recent introduction of optogenetic techniques. New collaboration with Sheffield biologists is developing a Research Centre for Sensory Neuroscience. This will focus on electrophysiology, imaging and computational modelling, combined with tractable animal models for in-vivo studies to bridge the gaps between molecular physiology, systems physiology and behaviour.

The second neuroscience group addresses **Computational Neuroscience and Robotics**. While fundamental research has continued to flourish, for example addressing computational dynamics in the cerebellum, an increased focus on applied research has been evident here, too. For example, Gurney's modelling has been applied to patient-specific models of Parkinson's disease and work on rat whisker sensing has been translated to models of human perception with application to low-visibility firefighting. The group has competed strongly in the current funding priority for developing assistive robotic technologies, which are expected to transform many human activities during the 21st Century. Notable achievements over the period include work on touch sensing and brain architecture in the world-leading 'iCub' humanoid robot and development of the 'Shrewbot', which navigates using touch alone. Cross-disciplinary work has been facilitated through SCentRo, founded by Prescott with 40 academic staff across five departments in the two Sheffield Universities. Recognising the strength of growth in this area, SCentRo will relocate to new-build laboratory space (750m^2) in 2015 with £3M university infrastructure investment. Driven by funder priorities and societal need, forward strategy will focus on fundamental and applied topics including assistive robotics, brain-based robotics, control for soft robotics, tactile sensing, decision-making, and human factors. Existing translational partnerships with CATCH, the Institute for In Silico Medicine (INSIGNEO) and the Advanced Manufacturing Research Centre will be developed.

Since 2008, the **Clinical Neuroscience and Psychiatry group** has pursued the strategic aim to identify the brain mechanisms underlying major mental illness using structural and functional magnetic resonance imaging (MRI), neuropsychology, and transcranial magnetic stimulation in both healthy and clinical populations. For example, the Sheffield Cognition and Neuroimaging Laboratory (SCANLab) has explored the cortical pathways underlying auditory hallucinations and the experience of humour in schizophrenia. Future research will focus on exploiting Sheffield's new 3T human MRI facilities (opened 2013) for understanding the effects of psychological, physical and

pharmacological treatments at the neural level in major mental and neurological disorders (schizophrenia, affective disorder, dementia). The appointments of Venneri and Shanks will allow development of cognitive and neuroimaging markers of cognitive efficiency in ageing to improve early and differential diagnosis of diseases causing dementia.

The **Clinical Psychology** unit has built on the RAE2008 aim of developing the multidisciplinary CPSR (led by Barkham). The CPSR has secured ~£1.25M NIHR funding for evaluation of psychological therapies provision, including initial evaluation of the national Improving Access to Psychological Therapies (IAPT) Programme, through both primary research and secondary analyses. Barkham and Hardy have continued to develop the Clinical Outcomes in Routine Evaluation (CORE) evaluation method (CORE Case Study) and widespread adoption of CORE by primary care mental health services has made very large datasets (>50,000 patients) available. The CPSR has taken the national lead in analyses of these CORE data sets, including the Royal College of Psychiatrists' and Department of Health's joint *National Audit of Psychological Therapies*. The CORE methodology has fed back into research into clinical psychology and related disciplines; for example, it has allowed examination of models of therapeutic processes and outcomes, including: the impact of sudden behavioural change; the relevance of therapeutic alliance to treatment outcomes; dose-effect relationships; equivalence of treatments; and individual therapist effects. Application of clinical practice data to inform the research base on treatment effectiveness has led to the development of the *Practice-based Evidence Paradigm*, as described in a book of the same name (Barkham, Hardy & Mellor-Clark [Eds], 2010). This offers a complementary approach to evidence-based practice, where clinical guidelines are informed by results from a limited number of randomised control trials, which critics have argued may not generalise to routine practice. Future CPSR plans will develop evaluation work, exploring clinical populations where practice-based evidence is limited and developing multilevel modelling of health service datasets. The appointment of Waller will support development of theory-based interventions for eating disorders, the appointment of Berry will allow the development of mindfulness interventions for children, and Lavda the development of interventions for people with appearance affecting conditions. Turpin will continue to evaluate self-help interventions for recovery from trauma (Self-Help Case Study).

The **Developmental Psychology** group's RAE2008 objective of establishing an EEG laboratory has been secured. This contains two state-of-the-art EEG measurement sets housed in dedicated lab space and also supports portability for field research. The laboratory has supported a range of projects including modelling social attention in autism, with associated fellowship awards (Leverhulme and ESRC). Further consolidation of the EEG laboratory will be achieved through strengthening collaborations with cognitive neuroscientists, for example to address heterogeneity within autism spectrum disorders and real-world skill acquisition. New appointments have strengthened capacity in other cognitive analysis methodologies, including eye-tracking (Freeth) and speech analysis (Matthews). Future strategy will maintain emphasis on impactful research. This will build on existing work that has informed the definition of disruptive disorders in DSM5, and has developed training for children with spatial impairments, parenting programmes to develop child language and educational interventions to improve quality of life in children with leukaemia.

Since RAE2008, a major aim of the **Social, Health and Environmental Psychology** group has been to secure its position as one of the world's leading centres for behaviour change research. Accordingly, more than £3M funding to address fundamental questions has been awarded. Projects have included: How are Emotions Regulated in Others and Self (EROS)? Can people act wilfully in the face of unwanted, nonconscious influences? Can "teachable moments" prompt healthy habits in young people? And why do people fail to monitor their behaviour? This work has resulted in a suite of funded interventions (e.g., using implementation intentions) that directly address key societal challenges, including reducing teenage pregnancy rates, promoting medication adherence and improving diet and exercise participation. Consistent with ESRC priorities, future plans are to develop an integrated centre for behaviour change research, drawing on established expertise in self-regulatory approaches to social and health behaviour and, following the appointments of Crisp and Jones, prejudice and environmental decision-making.

Mechanisms to develop and promote research: In 2012 we organised an external strategic review by Abrams (Kent), Calam (Manchester), Jones (Cardiff) and Winn (Strathclyde). We developed a 5-year vision and strategy (described above) that informed a major appointment round of 14 new academic staff in 2012. We have introduced two research away days per year that dovetail with Faculty "red-lining weeks", when staff are encouraged to focus on research writing and forging new collaborations. We promote three external seminar programmes focusing on psychiatry, clinical psychology and general psychology, as well as an annual 3-day postgraduate conference for postgraduate research (PGR) students. We also host regular discussion forums and journal clubs with cross-cutting themes such as human cognition, social psychology, EEG and mindfulness, which are attended by many external staff from engineers to occupational therapists.

Responsiveness to national and international priorities: We have responded to the impact agenda of our major funders, which involves addressing national and international social concerns. For example, our computational neuroscience research has focused on the national and international priority to develop robotic technologies for the future (e.g., as one of the UK government's Eight Great Technologies). IAPT evaluation responds to the UK government's initiative on introducing brief psychological interventions. Similarly, Venneri's work addressing dementia diagnosis responds to the European Parliament's 2011 resolution for a European Initiative on Alzheimer's disease and other dementias. Other examples include the appointment of C Jones as an environmental psychologist to link with the University's Project Sunshine, which addresses sustainable food and energy production, and the joint appointment of Millings with CATCH, which works on technology to support independent living for an ageing population.

Postgraduate Research student recruitment: PGR numbers have been sustained by introducing 3 four-year demonstratorships per year (since 2011). Our own Masters courses (Psychological Research Methods, Cognitive and Computational Neuroscience, and Cognitive Neuroscience and Human Neuroimaging) provide a stream of strong candidates and this is augmented by national advertisement. Forward PGR strategy will mirror our research strategy by maintaining support for fundamental research, while promoting multidisciplinary collaboration and non-academic impact. This will build on three recent University-funded cross-cutting studentship network awards on the use of robotic assistants in search and rescue, the neuroeconomics of uncertainty, and the environmental impact of wind turbines. These networks involve collaboration with Computer Science, Engineering, Economics, Architecture, Town Planning and Accounting.

c. People

Staffing strategy and staff development

We believe that there is a critical relationship between investing in our talent at all levels and delivering our research strategy. Reflecting our commitment to this relationship, the University received the HR Excellence in Research award from the European Commission (2012) and remains committed to applying the 7 principles of the UK Concordat for the Career Development of Researchers.

Selection and recruitment: Our recruitment strategy is designed to maintain critical mass within research groups with a complementary skill set, while making specific appointments to develop links between groups. Twenty-one staff have been recruited in the REF period. To maintain a sustainable staff structure we have favoured early career appointments with occasional senior appointments (e.g., Crisp, Waller, Venneri) to maintain balance. The high calibre of our early career appointments is illustrated by their success in publishing in high-impact journals (e.g., *Science*, *Psychological Bulletin*, *Psychological Science*, *Journal of Neuroscience*) and securing PI funding (Nuffield Foundation, British Academy, Electric Power Research Institute). We have successfully targeted the recruitment of independent research fellows, with funding from ESRC (2, 1 Future Leader), Royal Society, Leverhulme, EPSRC, NIHR Clinical Fellowship scheme (2) and the NIHR Clinical Lecturer scheme. The University also supports independent researchers: in 2013 the Vice Chancellor's Fellowship scheme advertised 20 fellowships, attracting more than 800 applicants. Howarth secured a senior fellowship in this scheme, providing funding for 5 years.

Staff Development: Development of research careers drives our ethos. Early-career researchers are provided with start-up funds (usually ~£4k, but up to £35k) and reduced teaching and administration responsibilities (≤ 50% in first year). An allocated mentor provides support through 3-year probation. Early career researchers are inducted at university level and access the University's Research Leaders' Programme, which provides training in grant application and research management, commercial awareness, enterprise and communication skills. Our NIHR Academic Clinical Fellows and Clinical Lecturer (Alhaj) participate in the NIHR Clinical Academic Training programme. The effectiveness of our approach is demonstrated by the outcomes for the 8 early career staff identified in RAE2008 who remain in post: 5 have been promoted to SL (or equivalent) and they have won prestigious grants (e.g., Webb – ERC Starting Grant, Berwick – MRC and Wellcome) together with publications in leading journals (e.g., *Psychological Bulletin*, *Journal of Abnormal Psychology*, *Archives of General Psychiatry*, *Biological Psychiatry*, and *Journal of Neuroscience*).

An integrated package of departmental and university support ensures the following: (a) *A supportive structure for career development:* All lecturers hold open-ended contracts and our research fellows typically move onto lecturing contracts. All staff undertake an annual review that provides feedback and goal setting, with funding available to support identified training needs. (b) *Facilities and Resources:* Academic staff receive an annual research budget and are given funding for conference attendance. Funds support research expenses on a competitive basis, for example eye-tracking equipment (~£50k). (c) *Protected research time:* Measures include: (i) a Workload Allocation Model to facilitate equal distribution of load, (ii) Study Leave (every 7th semester), (iii) concentration of teaching duties into one semester. (d) *Reward for research success:* There have been 8 promotions to SL, 2 to Reader, and 3 to Personal Chairs since 2008. Two research staff have been promoted from Researcher to Research Fellow and one from Research Fellow to Senior Research Fellow. Exceptional contribution awards for outstanding research performance have been made to academic (5), research (5) and support (3) staff.

Post-doctoral Research Staff on fixed-term contracts are on the same salary scales as permanent staff, and our salary scales are comparable with other research-intensive HEIs, so that we can be confident that these researchers are treated equally both internally and within the sector. They receive cognate-discipline tailored inductions that highlight available researcher professional development (RPD) opportunities. They then access a programme of RPD and career support training to fit their career track (balancing research and transferable skills), and a tailored researcher-mentoring programme designed to inculcate research independence. Independent Research Fellowship applications are encouraged and supported.

Equality and Diversity: Our staff have varied cultural backgrounds: we recruit the best people regardless of race, gender, nationality, sexual orientation, and religion. Retaining and developing excellent female staff is a major challenge for us and the sector more broadly. Senior roles in the UoA are held by females including Director of the Clinical Psychology Unit (Hardy) and 52% of the 21 appointments made in the REF period were female. The University has a high-level strategic commitment to be an employer of choice for women and has established a Science Faculty Equality and Diversity Committee to address any barriers to achieving this aim. The University operates a flagship Women Academic Returners Programme and a Springboard programme specifically to develop research careers for females. We have formed an Athena SWAN Self-Assessment Team to work towards a Bronze Award.

Research students

PGR students form an integral component of our research culture, making more than 100 contributions to publications since 2008. While the REF4 data indicate an increase in PGR numbers from 2011/12, this reflects the inclusion of DClinPsy students in HESA data, always considered to be research students, but previously reported via a different statistical survey (RAS). Overall, we have supervised 80 PhD students (97% four-year submission rate for 2004/05–08/09 starters) and 91 DClinPsy students. PhD destinations are 32% lecturers, 46% academic research, 8% clinical training and 14% other industries, with most DClinPsy students following clinical careers. The high calibre of our current PhD students is demonstrated by 81% holding a Masters degree. Their funding is 50% University, 20% RCUK, 15% overseas, 7% charities and 7% self.

We are integrated into the ESRC White Rose DTC, with staff contribution to the DTC core training provision, representation in the Advanced Quantitative Methods (AQM) Working Group (2 competitive AQM studentships secured since 2012) and student representation on the Academic Quality Committee. We hosted the first annual White Rose PGR psychology conference (2013). DClinPsy students participate in a regional annual trainee clinical research conference (with Leeds and Hull). Students host their own 3-day annual conference at which all PhD students present a talk (52 in 2013) and they receive funds for UK and overseas conference visits. They attend weekly internal and external seminars series and journal clubs, and are represented at staff and postgraduate studies committee meetings.

A QAA-commended integrated programme of PGR induction is conducted at White Rose DTC, University, Faculty and Departmental levels. All students complete a Training Needs Assessment, which is regularly reviewed via the Doctoral Development Programme (noted positively by the QAA). Training opportunities include modules from our taught Masters courses, courses provided across the university, and regionally through the White Rose DTC. Funding is provided for external courses. For example, students have attended the MRC Social Genetic and Developmental Psychiatry Centre Summer School (London), the Barcelona Summer School in Cognition, Brain and Technology and the International Workshop on Statistical Genetics (Colorado).

d. Income, infrastructure and facilities

Income: External income was £9.7M during the REF funding period. Key funders were RCUK (40%), EU (32%) and charities (16%). EU funding has increased substantially during the REF period (>£3M, a 354% increase since RAE2008). Building on the award of the Biomimetic Technology for vibrissal Active Touch (BIOTACT) FP7 grant (Co-ordinator and PI: Prescott) in RAE2008, we strategically targeted the EU, resulting in 9 subsequent FP7 awards and an ERC Starting Grant involving 12 UoA researchers. The EU is attractive because many of their thematic priorities link to our own (e.g., robotics, dementia) and they emphasise cross-disciplinary work, matching our own strategic focus. This allowed us to capitalise on existing international collaborations and, more importantly, provided opportunities to form new inter-disciplinary collaborations that were crucial for research progress. For example, Prescott, Porrill and Gurney were part of the Experimental Functional Android Assistant consortium (FP7 Cognitive Systems), allowing them to work on the world-leading 'iCub' humanoid robot, with a focus on developing touch-sensing capabilities in the robot's hands and contributing to the brain architecture that controlled the robot. The consortium encompassed the robot developers (Italian Institute of Technology) and partners in Spain, France and UK. Further examples of FP7 collaborations are given in REF5e. We were also attracted to EU funding because it can support large-scale projects that can make really substantial progress. This is evident in the FP7 projects and is also illustrated in Webb's ERC Starting Grant. This supports an extensive programme of research addressing when and why people fail to monitor their goal progress and applies the findings as a new focus for behaviour change interventions. While aspects of this work could have been supported by other funding agencies, only the ERC could fund the integrated programme.

Funding from RCUK for fundamental research has remained strong, supporting, for example, work on neurovascular coupling (e.g., BBSRC, MRC Programme grant [PI: Berwick]). RCUK has also supported our emphasis on multi-disciplinary research. For example, EROS (ESRC Large grant, PI: Totterdell) brought together our strengths in social cognition (Totterdell, Sheeran, Webb) and in human fMRI (Farrow). Other awards have supported our focus on applied topics, for example, in developing interventions for healthy living in young people (MRC). We have also been supported by charities, including developing animal models of epilepsy (Wellcome Trust) and parenting programmes for child language development (Nuffield). Government funding has also provided important support, for example for our health services research (e.g., NIHR Health Technology Assessment Scheme).

Infrastructure and facilities: Our research is facilitated by a comprehensive array of world-class facilities. Currently most of the Psychology department is housed in a purpose-built building, occupying 1466m^2, with two annexes adding an extra 604m^2. In recognition of our trajectory of growth, the University plans to replace these facilities with a £15–20M investment in a *3500m^2 new-build facility*. This will complement upgrades to our neuroscience facilities.

In 2012, the University invested £2M to relocate the Systems Neuroscience group to purpose-built *'wet' Neuroscience Laboratories* including investment in a new Bruker BioSpec 70/30 USR *7T small bore animal magnet*. This strategic investment provides unrivalled capacity for cutting-edge research, including: in-vivo and in-vitro electrophysiological recording, anatomical tract tracing, immunohistochemistry, structural and functional MRI and optical imaging spectroscopy (OIS). This is currently the world's only lab performing simultaneous MRI and OIS. This investment in animal models research complements Wellcome Trust infrastructure investment in a new (2013) *3T MRI magnet* for human research that is available to staff and students in this UoA.

Computational Neuroscience and Robotics will benefit from a £3M university investment to house SCentRo in 750m^2 new-build laboratory space (2015). This will be equipped with existing robot XY-tables and small mobile robot platforms, and new equipment from a £1M EPSRC infrastructure grant (2013). This grant will provide an iCub humanoid robot, Paro robot seals, a swarm of 800 Kilobots, three KUKA youBots (small mobile manipulators) and two swarms of outdoor ground and air vehicles. The facility will house a *Human Robot Interaction Laboratory* featuring the Noldus Observer Pro analysis suite, and a *Hybrid-Reality Laboratory* (for mixing physical and virtual reality) featuring a VICON multi-camera tracking system, a hybrid-reality design table for interactive design of smart spaces that include assistive robotic systems, and a Wireless 16-channel EMG system. This will complement an existing *Virtual Reality Laboratory* with motion-capture equipment.

In addition to the state-of-the-art neuroscience facilities, staff and students have access to more than 12 *Social Cognition Testing Rooms*, Qualtrics software ($3600pa subscription), which supports professional delivery of on-line research, and an *Early Cognitive Development Laboratory* with family-friendly parking and access. This contains two high-density EEG data acquisition systems, located in purpose built lab space, two laboratory based eye trackers, which include an Eyelink 1000 system offering 1000Hz tracking and an SMI mobile eye-tracker that records binocularly, and a head-mounted eye-tracker for infants. All researchers have access to the University's *High Performance Computing (HPC) Facility*, which has received £2M investment during the REF period. There is also access to the N8 Tier 2 HPC facility in which the University is a partner. Locally, we house *Computing Clusters* (120 core and 30 core) for simulation of large-scale neural networks.

A critical component of our strategy is to establish dedicated support staff to manage specialist research facilities and to provide key skills and training. Thus, the Neuroscience Laboratories are staffed by two senior technicians with expertise in a wide range of techniques. The small-bore animal magnet is managed by an experienced physicist (Kennerley), supported by a 0.75 technical post. SCentRo facilities will have technical assistance from all contributing departments. All of the above-mentioned technical posts are supported from core funds.

e. Collaboration or contribution to the discipline or research base

Collaboration

Mechanisms to enhance academic collaboration include: (i) Funded external speaker programmes, (ii) Support for national and international conference attendance, (iii) Study leave for research visits (>40 international visits since 2008) and (iv) Supporting visiting academics (>40 overseas visitors since 2008). Non-academic collaborations are facilitated by (i) the Sheffield Science Gateway, a £1.2M university investment in support staff to foster collaborations with non-academic partners, (ii) knowledge transfer funding including the University's EPSRC Knowledge Transfer Account and Higher Education Innovation Fund (>£90k to this UoA since 2008), and (iii) University consultancy services that support up to 35 days' consultancy pa (£215k since 2008).

International collaboration is strong; 32% of our papers involved international authorship. Of these papers, 56% involved Europeans, 35% North Americans, 13% Canadians, 10% Australians and 16% an author from elsewhere in the world (including New Zealand [11 papers], Japan [5] and Brazil [3]). Many collaborations involve work across multiple borders, often supported by EU funding. For example, Prescott led the BIOTACT FP7 project (2008–12), involving 9 partner institutions from 7 countries. This combined our expertise in biomimetic robotics and computational neuroscience (Prescott, Porrill, Gurney) with international expertise in mammalian neurobiology

(Italy, Israel, Germany) and computational modelling and robotics (USA, UK, Switzerland). The project has developed the "Shrewbot" robot that navigates by touch rather than vision. Our contribution to the FP7 Bio-ICT programme REALNET provided our computational neuroscientists (Porrill & Dean) with access to cerebellar models and data from a world-leading team in Pavia (Italy), with further collaborators in Spain, Germany and Israel. Venneri's work on the FP7 "Virtual Physiological Human dementia research enabled by IT" project supports collaboration with world-leading engineering, physical, biomedical and clinical scientists, and leading dementia experts.

We have more than 140 *national collaborations*. For example, Rowe collaborates with psychologists, psychiatrists, behaviour geneticists and statisticians at Goldsmiths College and the Institute of Psychiatry on the Genesis1219 study. Genesis1219 is an on-going longitudinal study following 3640 twins and siblings, so far covering development from age 14 to 25. Rowe has responsibility for research data management and has prepared datasets used by over 20 collaborators who have produced more than 30 peer-reviewed papers. EROS also exemplifies our approach to national collaboration. Our own expertise in emotion regulation in organisational (Totterdell) and health (Sheeran, Webb) contexts was augmented with emotion regulation expertise in interpersonal relations (Oxford), sports (Wolverhampton), goal conflict (Manchester) and child development (Reading). The project also involved academic collaborators from 8 countries in 3 continents and non-academic collaborators included the BBC, who ran a website study attracting >70k participants. EROS has led to 80 papers so far, including publications in high-impact journals such as *Emotion*, *Personality and Social Psychology Review*, *Journal of Consulting and Clinical Psychology* and *Psychological Bulletin*.

Local collaborations are facilitated through University multi-disciplinary research centres. We lead two important centres; Prescott directs SCentRo, which contains 40 academic staff across the two Sheffield Universities with collaborators in engineering, computer science, chemistry, architecture and art. SCentRo were the lead UK Partner in the FP7 CA-RoboCom FET Flagship pilot project on "Robot Companions for Citizens". As co-ordinator of the Society Community Working Group (containing 50 international scientists), the centre was responsible for generating roadmap reports on the potential societal impact and ethical and legal implications of robotics research. Barkham leads the CPSR, which contains 10 staff including health economists, decision scientists, and health services researchers. Our staff also contribute to other centres, including the Institute for In Silico Medicine (C Martin, Gurney), Music, Mind and Machine (Overton, Rowe), CATCH (Sheeran, Millings, Webb) and Project Sunshine (C Jones). Other local collaborations also highlight our multidisciplinary work. For example, our neuroscientists work with chemists, physicists and computer scientists to engineer virus-like nanoparticles.

Non-academic collaborators include stakeholders at local (e.g., regional councils, regional health care providers) and national level (e.g., NHS, Department of Health, National Literacy Trust, Diabetes UK), and industry (e.g., Unilever, BAE Systems, Cyberbotics, Brain Vision Systems). For example, CPSR's collaboration with the NHS allows access to large-scale datasets addressing therapeutic effectiveness, collected during routine care, allowing application of the practice-based evidence paradigm. The Big Energy Upgrade project (C Jones, Webb) involves 6 local authorities, 6 social housing providers and an energy advice company (YES). This allows study of the impact of energy efficiency interventions in areas facing severe economic disadvantage.

Contribution to the Discipline

Peer review: Five staff held Editor-in-Chief roles for academic (*Journal of Applied Social Psychology*, *Infant and Child Development*, *British Journal of Clinical Psychology* [2 joint editors]) or practitioner (*Clinical Psychology Forum*) journals. We provided 7 associate editors (including *Journal of Experimental Social Psychology*, *Applied Cognitive Psychology* and *International Journal of Eating Disorders*) and more than 50 Editorial Board members (including *Health Psychology*, *Personality and Social Psychology Bulletin* and *Behaviour Research and Therapy*).

Many staff work closely with major funders. Crisp sits on the ESRC Grants Assessment Panel A and was on the steering committee of the 2011 ESRC International Benchmarking Review, to which Nicolson and Turpin were invited to provide evidence. Venneri was Deputy Chair of the MRC Biomedical Informatics Training and Career Development Panel (2005–10). Turpin was a panel

member for the Romanian RAE (2011). Woodruff was an invited expert for the Finland Academy of Science 2010–12. Many staff review for major UK funders including 18 for ESRC (5 college members) and 9 for MRC. Thirteen staff have reviewed for international funders, including the National Science Foundation (US), Science Research Agency (France), Fondecyt (Chile), the Australian Research Council, the Social Sciences and Humanities Research Council of Canada and the Israeli Science Foundation. Prescott has reviewed for FP7 Future Emerging Technologies and contributed to developing new calls.

Academic Conferences, Meetings and Research Training events: Our staff have given more than 80 international and 40 national keynote or plenary lectures. We hosted the 2009 BPS Social Section Conference. Since 2011, Prescott has organised the annual "Living Machines: Biomimetic and Biohybrid Systems" conference sponsored by the EU Convergence Science Network. Prescott also organised a Theo Murphy Discussion Meeting on Active Touch Sensing at the Royal Society's Kavli Centre, which was published as a special issue in *Philosophical Transactions of the Royal Society B*. Crisp organised a Multiculturalism and Diversity pre-conference event at the Society for Experimental Social Psychology annual conference, Washington DC. Prescott co-organises the annual Barcelona Summer School in Cognition Brain and Technology (started in 2008) for the EU Convergence Science Network and hosted an international workshop on Rhythmicity and Motor Control in Sheffield as well as smaller workshops on Developmental Robotics and Societal Impacts of Robotics. With British Academy funding, we offered training on using LENA to automatically analyse speech at workshops in Sheffield and the University of Costa Rica.

Learned Societies: We have housed 5 Academicians of the Academy of Social Sciences (JR Eiser, Slade, Turpin, Crisp, Sheeran) and our staff hold 20 Learned Society Fellowships, including the BPS (9), the Association for Psychological Science, the Royal Society of Medicine, the Society of Biology and the Association of European Psychiatrists.

Many staff have held key roles within learned societies: Norman was President of the European Health Psychology Society (2010–12), Beail was President and Vice-President of the European Association for Mental Health in Intellectual Disabilities and Hockey was President of the Human Factors and Ergonomics Society European Chapter (2009–12). Waller will be President-Elect of the Academy for Eating Disorders (2014–15). Crisp and Turpin sit on the Research Board of the BPS of which Crisp was Deputy Chair (2009–12). Herbert is Treasurer-Elect for the International Society of Developmental Psychobiology. Waller sat on the Scientific Committee of the European Association for Behavioural and Cognitive Psychotherapy (2011–13) and sits on the Scientific Committee of the British Association for Behavioural and Cognitive Psychotherapy (since 2011, co-chair 2013–16). Woodruff was elected Deputy Chair (2008–11) and Chair-elect (2011–present) of the Academic Faculty of the Royal College of Psychiatrists and was the Academic Representative on their Policy Committee with responsibility for Faculty responses to national consultations. Turpin was a BPS Trustee, elected to the BPS Representative Council (2007–11) and Director of the Professional Standards Unit of the Division of Clinical Psychology (2007–09).

Recognition of our contribution to the discipline includes the 2013 BPS Social Section mid-career award for Crisp, the 2009 Distinguished Contribution to Professional Psychology award from the BPS Professional Practice Board and the 2012 M B Shapiro Award for Lifetime Contribution to Clinical Psychology from the BPS Division of Clinical Psychology for Turpin. Kennerley won the AstraZeneca prize for in-vivo MRI research (2010) and the Mansfield prize (2013) from the British Chapter of the International Society for Magnetic Resonance in Medicine.

In Summary, the staff of this UoA make a central contribution to psychology, psychiatry and neuroscience research, both at UK and international levels. This is demonstrated by the quality of research inputs and outputs, and depth and breadth of contributions and accolades described here. Our achievements reflect the outstanding research environment provide by the University of Sheffield that has supported us during the REF period and will continue to allow us to address the most important challenges in behavioural science into the future.