Institution: Plymouth University

Unit of Assessment: B11 Computer Science and Informatics

a. Overview

Research in Computer Science and Informatics at Plymouth University is mainly carried out at the **Centre for Robotics and Neural Systems** (CRNS), an area highlighted in the University Research and Innovation Strategy as a key area for investment and development. The Centre comprises an interdisciplinary group of 15 staff, with 14 included in this UoA11 and 1 in UoA4. CRNS was established in 2010 from the integration and enhancement of the two Centres submitted in RAE2008 (Theoretical and Computational Neuroscience; Interactive Intelligent Systems). In Spring 2012, CRNS, together with other University Research Centres with specialist interests in psychology and neuroscience research, led the creation of the new Plymouth Cognition Institute. This has further broadened the interdisciplinary reach within the University, and provides a strategic critical mass and long-term sustainable base for international engagement in research across natural and artificial cognitive systems.

Since 2008 there has been a steady increase in the international quality of robotics and neural systems research at Plymouth, with corollary leadership and standing in cognitive robotics and computational neuroscience internationally. This has been achieved through strategic investment of University QR funds in new staff, studentships and lab infrastructure (£1.8m in 2008-2013); a portfolio of major new grants from RCUK and FP7 (six-fold increase from £2m in RAE2008 to over £13.5m in REF2014); the setup and coordination of numerous interdisciplinary, large-scale EPSRC and FP7 international collaboration projects; the award and coordination of two Marie Curie doctoral training networks; and direct engagement with industrial partners, research users and policy makers.

b. Research Strategy

The **strategic vision** of the CRNS embraces world-class interdisciplinary research investigating the neural and cognitive bases of behaviour and cognition in both natural and artificial cognitive systems (thus including humans, animals, and robots), and the establishment of an international research hub in the integration of cognitive robotics and computational neuroscience. These are pursued through publication in leading journals, development of state of the art cognitive robotics labs, and research income from leadership in large, EPSRC and FP7 international consortia. CRNS has an international reputation for leadership in cognitive robotics modelling of action and language learning, developmental and epigenetic robotics, human-robot interaction for children and the elderly, mathematical and computational modelling of the neocortical circuitry underlying visual and auditory perception, nonlinear dynamics to model working memory, timing, and learning processes, neuroscience investigation of motor learning and embodiment, and the application of computational and robotics modelling methods to psychology, neuroscience, and animal behaviour.

Research governance in CRNS is based on the work of the Director (**Cangelosi**) and a team of senior staff for co-leadership of the robotics area (**Belpaeme**) and of the computational neuroscience area (**Wennekers**). Staff meetings and thematic away days (e.g., on PhD students' presentations and on research impact strategy) are used for comprehensive discussion and review of the groups' progress and future plans and for team building. The Centre significantly contributes to the activities and plans of the Cognition Institute: e.g., through Cangelosi's membership of the Institute's Executive Committee. Annual reports to the University's Research and Innovation Committee permit the regular appraisal of the Centre's progress and facilitates the driving of the University's research agenda and priorities in computer science, robotics and computational neuroscience.

CRNS research strategy is guided by a strong commitment to the research and innovation priorities of the UK and EU. Most notably, we have responded to:

- The UK Government's selection in 2012 of "Robotics and Autonomous Systems" as one of the 8 Great Technologies, with subsequent support from EPSRC and TSB programmes.

- The EPSRC Shaping Capability initiative, which identified Artificial Intelligent Technology, Robotics, and HCI (including Human Robot Interaction) as areas of continued investment.
- The BBSRC focus on computational models of animal neuroscience and behaviour models.
- The EU FP7 ICT work programme - Challenge 2 on Cognitive Systems, Interaction and Robotics, Challenge 5 on ICT and Health.
- The EU FET Proactive Initiatives on Embodied Intelligence (EMBODYi) and Neuro-Bio-Inspired Systems (NBIS) and the FET Flagship and ERA-NET on the Human Brain Project.
- The EU Horizon 2020 Public Private Partnership (PPP) initiative in Robotics.

CRNS strategy is to support the vitality and sustainability of research in robotics and neural systems through **5 Strategic Objectives (SO)**, which are regularly monitored and reviewed by the Centre's Director (**Cangelosi**) and management team in consultation with academic and industrial/user advisors:

SO 1. To employ interdisciplinary approaches to cognitive robotics and computational neuroscience through close collaboration with scientists from cognitive and neural sciences (e.g., child psychology, cognitive neuroscience, psycholinguistics, marine biology) and engineering (e.g., neuromorphic engineering, mechatronics), through membership of the Plymouth Cognition Institute's Centre for Brain, Behaviour and Cognition and internationally with the well-established network of collaborators in FP7 grants.
SO 2. To disseminate research results in world leading scientific journals and conferences, and to pursue translational and knowledge exploitation opportunities.
SO 3. To foster personal development opportunities for students and staff supporting research productivity and career progression within an international, multicultural research environment.
SO 4. To secure a steady-stream of grant income from the UK, European and international funding agencies to provide sustainable resources for the training of PhD students and researcher development with access to state-of-the-art lab facilities.
SO 5. To encourage research leadership and engagement with the national and international communities of cognitive robotics and computational neuroscience, with industrial and user group partners, and with active involvement in outreach activities with the public and schools.

Building on the Unit's achievements in these strategic objectives over the last 6 years (see sections below), the plans and research priorities for the next five years comprise;

- Strategic investment through University's QR funding, School staffing strategy and EPSRC and EU grant bids to contribute to the UK Great Technology initiative on Robotics and Autonomous Systems and the EU Horizon 2020 PPP in robotics.
- Further collaboration of the computational and cognitive neuroscience staff with psychology, medical and neuroscience researchers at the Cognition Institute for interdisciplinary investigations on methods and technologies for motor and neurocognitive rehabilitation.
- Closer alignment and integration of the computational neuroscience approach and the cognitive robotics research for novel neuro-robotics model of sensorimotor and social learning, e.g. for follow-up projects building on the EPSRC BABEL project.
- Additional investment, through the hiring of new staff and lab facilities in ambient intelligent, to contribute to the scientific and technological challenges of assisted living and integration of robot companions in ambient intelligent systems for service and healthcare robotics

c. People, including:

***c.i* Staffing strategy and staff development**

Staff appointments and career progression are guided by strategic needs and by a commitment to staff retention and the importance of leadership succession. Key appointments at various levels since RAE2008 have been **Metta** as professor (part-time), **Howard** as Associate Professor and **Yang** and **Rodrigues** as ECRs. Of the staff included in the RAE2008, two have benefited from accelerated promotion for research performance: **Belpaeme** to Reader then Professor and **Durstewitz** to Professor. Flexible remuneration packages have been applied to retain key CRNS

staff, and to secure leadership and succession planning. In line with SO 5, we have sought to make international appointments. Since 2008, we have recruited **Yang** from China, **Rodrigues** from Portugal,l and **Metta** from Italy. Nine CRNS staff now originate from overseas.

Career development and leadership succession are key principles, embodied in Strategic Objective 3. We are fully committed to the Concordat to Support the Career Development of Researchers, under which PU received the HE Excellence in Research Award, and we support research assistants and ECRs through the following initiatives:

- *Mentoring*. Each new member of staff is allocated a mentor for specific guidance on research, career development, and grant writing. Mentors meet mentees regularly for informal support.
- *Performance Development Review (PDR) and research workload*. In 2012 the University introduced formal PDR to identify staff development needs and workload adjustment for research allocation. All staff are reviewed by the Centre Director, who is able to arrange access to internal courses or funding for external courses.
- *PhD Studentships for Early-Career Staff*. During the REF2014 period at least 50% of internally funded PhD studentships were priority-allocated to ECRs to kick-start their research productivity and supervisory experience (e.g., **Yang**, **Marocco** and **Rodrigues**).

The Centre runs a vibrant seminar series with internal and external speakers and through which we seek to underpin SO2, provides opportunities for junior to develop presentation skills and foster interdisciplinary collaboration. Each member of staff can directly invest part of the external research income overheads into a Strategic Research Account to support their research and career needs (e.g., for employing teaching assistants, buying equipment, travel, visiting students/staff).

Equality and Diversity issues in relation to recruitmnent, promotion, and research support are regularly monitored through the CRNS and the School for report to the Faculty Research Committee. The Faculty of Technology was awarded the Silver Athena SWAN Award for support for women academics and has applied its principles to the structures dealing with equality and diversity. For example, resources available have enabled direct measures of support to be put in place to allow a female member of staff to remain research active in difficult circumstances.

***c.ii* Research students**

PhD students in CRNS are organised into the newly formed Doctoral Training Centre in Computer Science and Mathematics, operating under the umbrella of the Graduate School. This allows students to be supported as part of a cohort that enjoys interdisciplinary training that combines computing training with skills in mathematics and engineering. Courses in transferable skills and professional development are provided by the Graduate School. Student progress is monitored and reported to the Graduate school through an electronic log system that provides an early warning of any issues of academic progress. Supervisors undergo training, provided by the Graduate School, and are supported by a peer support network and a mentoring system for ECRs without prior supervisory experience. A pairing of experienced with less-experienced supervisors is seen as an essential aspect of staff development. For career development purposes, PhD students and postdocs who have followed a University teaching training course are offered opportunities for teaching and undergraduate-project supervision.

Students are fully integrated into our internationalised research culture and network of collaborators. To foster their career development, progression and retention, they are encouraged to undertake exchange visits to the many collaborating labs abroad. To ensure conversion of postgraduates into postdoctoral and early academic positions, here and elsewhere, we allow selected PhD students and postdocs to be included as named RAs in grant applications. This has been the case with Peniak and Morse in the POETICON++ project and Rucinski in the uTALK proposal.

Opportunities for postgraduate research within highly interdisciplinary, international networks are available through two major FP7 Marie Curie doctoral training centres. CRNS is the coordination

node of the EU FP7 Marie Curie Initial Training Network (ITN) "ROBOTDOC: Robotics for Development of Cognition" (2009-2014, €3.5M, with €832,473 at Plymouth) and of the COGNOVO Innovative Doctoral Program (2014-2017, €4.07M all as Plymouth award). ROBOTDOC provides support for 17 Marie Curie Fellows, of whom 3 are based at Plymouth and includes academic partners in Sweden, Switzerland, Italy, Germany, Japan, Usa and Taiwan, and industry partners in Italy and Germany. COGNOVO provides funding for 14 Fellows and a further 12 internally funded studentships beginning in 2014. All COGNOVO students are based in Plymouth, and benefit of a network of 26 international academic and industry partners. CRNS staff will be primary supervisors for 8 of these students.

All PhD students in CRNS have access to ROBOTDOC / COGNOVO academic, industrial and transferable skills courses. 12 CRNS students have benefitted from ROBOTDOC training activity: 8 in the Cognitive Robotics Research Methods Workshop (Plymouth 2010), and 4 in the Interdisciplinary Methods Spring School (Budapest 2011). Nine Plymouth PhD students in Computer Science and Informatics are Associate Fellows of the ROBOTDOC network.

In addition to visits from senior academics, our students and our research environment have benefitted from the presence of a number of visiting doctoral students seeking interdisciplinary training at CRNS. Students come from NTUST Taiwan; Southern Illinois University USA; universities in Zurich, Amsterdam, Madrid, Brussels, Ankara, and Thessaloniki. - Former CRNS PhD students and postdocs have been employed in leading international institutions, including E. Coutinho at Geneva University, S. Dura Bernal at Johns Hopkins University then State University of New York, L. Lanyon to Karolinska Institutet (now Head of Programs, International Neuroinformatics Coordinating Facility Secretariat),and E. Balaguer Ballester at the Bernstein Center for Computational Neuroscience at Heidelberg University. Students have also been employed in UK and international companies, as EADS Astrium and the MET Office, and have had industrial placements at places as the European Space Agency (ESA ESTC Netherlands) and at NVIDIA (Santa Clara, USA). CRNS PhD graduates have also setup spin-off companies based on their PhD research (e.g., Syntheligence, Scholarly).

d. Income, Infrastructure and Facilities

Specialist labs equipment and investments in research infrastructure

CRNS research facilities are organised around four main state-of-the-art laboratories, variously funded by University infrastructure investment, research grants, and industry contributions.

The *Cognitive Robotics and Human-Robot Interaction Lab* hosts the iCub humanoid baby robot platform, one of the most advanced platforms for cognitive robotics research. The €200K iCub robot, funded by the ITALK project, arrived in March 2009, and was upgraded in 2012 with advanced tactile sensors and robot skin for the forearm and hands (€30,000). The lab also has six Nao Aldebaran humanoid robots used in HRI experiments of the ALIZ-E project, a MetraLab Scitos G5 mobile platform for the ROBOTERA project on robot companions for the elderly, and a Gypsy VI full-body motion capture suit.

The *Computational Neuroscience and Brain-Machine Interaction Lab* provide access to neuromorphic hardware and brain-machine interaction equipment. The projects COLAMN and SCANDLE funded the purchase of neuromorphic silicon retina and auditory systems. These are used as test-beds and for outreach activities. More recently, through collaboration with Manchester University, two SpiNNaker chips have been integrated to the Bioloid robot platform, and will be later extended to the iCub in the EPSRC BABEL project. A National Instruments FPGA is used for Brain-Machine Interface experiments. For motor neuroscience research, two vBot manipulanda robots (90K) and a three dimensional 3BOT robot apparatus (£60K) are used.

The *Humanoid Robot Football Robotics Lab* employs 12 Bioloid humanoid robots used for research in vision and walking behavior, as well as for outreach robot-football activities. Since 2008 the Faculty of Science and Technology and the University have invested heavily in our robot football technical developments. Most recently (2011-14) a two-year development plan was established in preparation for the international FIRA RoboWorldCup and the RobotCub competition (£350,000 University investment). The Faculty has also made available to CRNS a full time robotics technician. The Bioloid robots are also used for teaching in the BSc/BEng/MSc/MRes

Robotics courses.
The *Apple and NVIDIA Parallel Computing Lab* has received recognition and awards for its work on GPU and parallel programming applied to robotics and computational neuroscience. This has resulted in the in-kind grant of high specification computing hardware from both Apple and NVIDIA. In 2008 the University was awarded the Apple ARTS (Apple Research and Technology Support) Award for the setup of the "P-ARTS: Plymouth Advanced Robot Training Suite", with a cluster of 4 Apple XServers ($30,000), and the title of "Apple Laureate" for Marocco. In 2012 Plymouth was recognized as a Professorial Academic Partner by NVIDIA Plc, and was awarded a set of 30 Tesla GPU cards. These were integrated in the FP7 funded cluster of 24 GPU cards. Further high performance computing facilities at CRNS include the COLAMN funded Linux Beowulf computer cluster with 80 cores and fast interconnect (Myrinet, £65k), and access to the University High Performance Computing Facility.

In addition to these main labs, the CRNS hosts other specialised equipment such as a Plankton Image Analyser system used by Culverhouse (£51K from HEIF III-IV) and the Information Visualisation Lab used in the Stuart and Borisyuk EPSRC CARMEN project.

Research Funding Portfolio

The Unit has seen a substantial increase in grant portfolio and income during the REF2014 period (Strategic Objective 4). The external *income spent* in this period is *£5.2M* (12.4 FTEs), up from £1.8M in RAE2008 (11.25 FTEs). Grants awarded before 2008 and continuing in the REF period include the FP6 projects FACTES and EMCAP, a US Air Force Lab project on robot imitation, and the EPSRC projects CARMEN and COLAMN. The value of *new grants* from RCUK and FP7 and US agencies in 2008-2013 is in excess of *£13.5M*, over six-times the £2M received in the RAE period to 2008. Moreover, staff in the Unit have distinguished themselves in the initiation and coordination of new large, multi-national EPSRC and FP7 projects: EPSRC £1.6M BABEL and £800K VALUE projects; FP7 €8.5M ALIZ-E, €6.25M ITALK, €2.6M SCANDLE projects, and the €3.4M Marie Curie ITN ROBOTDOC and the €4.07M IDP COGNOVO.

As a summary of new grants (>10K):

- 10 grants from EPSRC, BBSRC, and Wellcome Trust with a total value of over £3.4M;
- 11 grants from FP7 and ESA projects with a total value of €11.6M (~ £10M);
- 4 grants from the US Air Force and Apple ARTS with a total value of $753K (~ £500K)

e. Collaboration or Contribution to the Discipline or Research Base

The national and international collaborations outlined below reflect significant achievement of CRNS Strategic Objectives 1 and 5. These collaborative networks evidence CRNS international leadership and standing, particularly in the fields of novel computation with neuromorphic systems, cognitive robotics, human-robot interaction, mathematical biology, computational neuroscience, motor learning, grid computing and robot-ambient intelligence.

We lead numerous national and international collaboration networks including **Wenneker**'s £1.9m EPSRC project COLAMN (2005-2010) with UCL, Oxford), Edinburgh, and Manchester; **Cangelosi**'s £800K ESPRC project VALUE with Plymouth Psychologists and Dundee and £1.6m EPSRC-BBSRC project BABEL with Manchester, MRC Cambridge, and Freie Universität Berlin); **Belpaeme**'s £8.5m project ALIZ-E with DFKI Germany, Vrije Universiteit Brussel, TNO Netherlands, Imperial College, University of Hertfordshire, and San Raffaele Hospital Milan; the **Metta** and **Cangelosi** €6.25m FP7 project ITALK with the Italian Institute of Technology, Hertfordshire, CNR Rome, Bielefeld, University of Southern Denmark, and RIKEN Brain Science Institute; **Marocco**'s network grant for new collaborative links with Osaka University and Tokyo University; **Borisyuk**'s project on deep brain stimulation with Imperial College and the University of Luebeck and involving the Centre for Research in Translational Biomedicine and the Medical School at Plymouth University; **Rodrigues**'s work with King's College Centre for Epilepsy, with Harvard University, Salk Institute, and UCSD; and **Howard**'s collaboration with Cambridge, Osaka, and Pronunciation Science Ltd.

We are also participants in consortiums with institutions including **Borisyuk** and **Stuart** in the £5 Million EPSRC project CARMEN; **Cangelosi** and **Metta** in the €3 Million FP7 project "POETICON++: Robots Need Language", with L. Fadiga at the Italian Institute of Technology, V. Santos at the IST Lisbon, K. Pastra at CSRI Athens, and Y. Aloimonos at the University of Maryland USA; **Cangelosi** and **Belpaeme** in the €8m FP7 project ROBOT-ERA project coordinated by Paolo Dario at SSSA Pisa and with test sites in Italy and Sweden, and **Belpaeme** in the €6m project DREAM, coordinated by Skovde University, and with clinical test sites for children with autism in Romania.

The CRNS is a member of the EU's *Public Private Partnership in Robotics*, which is helping defining the priorities of the Horizon 2020 robotics programme. Within the PPP, we are member of the Topic Group on Robot Companion for Healtcare. **Cangelosi** further contributed to the European robotics research agenda through the organization at the EU Parliament of the debate on "European Research Leadership in Robotics" (31/3/2012). This included key EU Commission research leaders: Robert-Jan Smits (Director General, Research & Innovation), Libor Kral (Head, Cognitive Systems & Robotics), Ioannis Sagias (Chair, ERC Computer Science Unit).

The Centre is also a highly sought-after host institute for visiting academics from international labs. Over 30 incoming visiting scholars since 2008 include Prof. G. Palm (Ulm University), Prof. H. Iizuka (University of Osaka), Prof. Jing Li (Xidian University China), and Dr M. Arumugam, Adjunct Professor at MIT Zaragoza and CEO / founder of Broadline Inc. (India) as CRNS Visiting Professor with the specific brief of supporting knowledge transfer.

The examples of collaborations noted above demonstrate the extensive and intricate network of interdisciplinary work between CRNS staff and experts across a range of disciplines in labs worldwide. Most of these collaborations are characterised by a highly interdisciplinary research approach, with specialists in developmental psychology, animal biology, neuroscience and neuromorphic engineering. Through the coordination of the PF7 Integrating Project ITALK and of the recent Marie Curie Fellowship grant ORATOR, **Cangelosi** and **Belpaeme** have established a focused set of collaborations with child psychology labs (BabyLabs) worldwide: in the US with Linda Smith's BabyLab at Indiana University, in the UK with Towmey at the Sussex WORD Babylab and Wu at Birkbeck Babylab, and at the Plymouth Babylab (School of Psychology) with Floccia.

Interdisciplinary work with neuroscientists has been carried out in the COLAMN, VALUE, SCANDLE, BABEL projects by **Wennekers,** and **Cangelosi** and involves collaboration with the Freie Universitaet Berlin, Manchester University, ETH Zurich, and Johns Hopkins. **Howard** continues his collaboration with Wolpert and Franklin (Cambridge) on the effects of context in motor learning, with Haruno (Osaka) on rewards for motor learning and with Messum (Pronunciation Science Ltd) on robotic models of infant speech. **Borisyuk** collaborates with the animal neurodevelopmental labs at Bristol University and at St Andrew University (supported by two joint BBSRC grants) on computational modelling of axon growth in the tadpole and frog.

In clinical research, **Harris** has been involved in phase 2 translational research with funding from Oxford Glycosciences; and **Durstewitz** has continued his long-standing collaboration on dopamine function with University of British Columbia. **Rodrigues** collaborates with King's College Centre for Epilepsy, with Lieber (Harvard University) on novel nano-technology for electrophysiology and with Sejnowksi (Salk and UCSD). **Durstewitz** and **Borisyuk** are collaborating on the modelling of dopamine receptors in the Basal Ganglia in normal conditions and in the case of Parkinson's Disease, integrating **Borisyuk**'s dynamical system approach with **Durstewitz**'s neuron modeling system.

Collaboration with research users and policy makers is central to Strategic Objective 5. Cognitive robotics research on the humanoid platforms iCub and Nao, has involved close collaboration with nurses, doctors, and clinical psychologists working with children and the elderly in the San Raffaele Hospital in Milan, the Wilhelmina Kinderziekenhuis in Utrecht, and various other European

hospitals. Test sites for evaluation of the robot companion platforms for the elderly are based at the Casa-Lab Domotica, the assisted-living residence in Ghizzano-Peccioli Italy, and in customized living facilities at the residential home apartments in Ängen Swede built by Länsgården Fastigheter AB.

Our leadership role in the academic community is secured through membership of national and international advisory boards, industry and professional associations, Research Councils, and learned societies. **Cangelosi** was a Computer Science Panel member of the Research Assessment Exercise in Romania (R-RAE 2012), and of the 2013 evaluation of the Italian Universities. In 2012-2013 he was the Chair of the IEEE Computational Intelligence Society Technical Committee on Autonomous Mental Development (IEEE CIS AMDTC), and is Fellow of the British Computer Society; **Belpaeme** was a member of the 2011 UK-Japan mission organised by the Technology Strategy Board and the UK embassy in Tokyo; **Culverhouse** is co-founder and co-chair of the Automatic Plankton Identification Working Group of the International Scientific Committee for Oceanic Research; **Belpaeme** and **Cangelosi** are IEEE Senior Members, and with **Wennekers** they are members of the EPSRC Peer College. Since 2009 **Belpaeme** has been on the ACM/IEEE Human-Robot Interaction Steering Committee. All staff are regular referees of national, EU and international grant applications.

Three major conferences have been organized by CRNS staff: **Belpaeme** and **Bugmann** were Chairs of TAROS-2010, and **Cangelosi** was General Chair of the 2011 and of the 2013 IEEE ICDL-EpiRob Conferences, respectively in Frankfurt and Osaka. Staff have chaired international workshops hosted in Plymouth, including **Borisyuk** and **Wennekers** for the STM2010 Workshop, **Cangelosi** for the SCL2010 sponsored by US Air Force Lab, and **Marocco** for the International Workshop on the Emergence of communication. CRNS Staff have also been co-organising Chairs / PC chairs of over 30 other conferences and workshops. Major keynote lectures have been delivered at the 6th ACM/IEEE International Conference on Human-Robot Interaction (HRI-2011) in Lausanne, at the 2012 Parallel Problem Solving from Nature Conference (PPSN-2012) in Taormina, at the 2012 Artificial General Intelligence conference (AGI-2012) at Oxford and the 12th International Conference on Auditory-Visual Speech Processing (AVSP-2013) in Annecy, France. In addition, staff have given 6 other keynote talks, and over 20 invited speaker invitations at international conferences.

CRNS staff contribute as editors-in-chief and associate editors of 17 journals, including major IEEE and open access journals. A selection of these are **Cangelosi** as Editor-in-Chief of *Interaction Studies*; **Wennekers** as Associate Editor of *PLoS ONE* and *Frontiers Neuroinformatics*, **Borisyuk** as Associate Editor of *Neural Networks*; **Cangelosi** as Associate Editor of *IEEE Computational Intelligence Magazine* and of the *IEEE Transactions in Autonomous Mental Development*; and **Culverhouse** as Associate Editor of *Ecological Informatics*. They also serve in the editorial board of numerous international journals.

Plymouth staff have guest edited 11 special issues since 2008, including **Belpaeme** in *Journal of Human-Robot Interaction* (2013) and *Interaction Studies* (2009); **Marocco** in *Connection Science* (2008) and *Adaptive Behavior* (2013); **Cangelosi** in *Frontiers in Neurorobotics*, and **Wennekers** in *Philosophical Transactions of the Royal Society A* (2011), in the *Journal of Neuroscience Methods* (2012), and in *Neural Networks* (2009). **Belpaeme**'s Interaction Studies issue and **Wenneker**'s *Philosophical Transactions of the Royal Society* issue were subsequently selected for publication as books, given the high quality and impact of the work included.

Highlights of staff and postgraduate student awards include: **Yang** gaining a Marie Curie Postdoctoral Fellowship, **Marocco** a 2010 "Apple Laureate" for the ARTS (Arts, Research in Technology and Science) award programme; **Cangelosi** becoming one of 12 European academics selected in a 2012 pairing programme with MEPs, and the award to R. Merrison (**Borisyuk**'s PhD student) of a prestigious scholarship from the Fields Institute for Research in Mathematical Sciences (Toronto).