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Human Interface laboratory

Dr. Etienne Burdet (MS Mathematics, MS Physics, PhD, ETH-Zürich) is Chair in Human Robotics at Imperial College London and a Honorary Professor at University College London. He uses an integrative approach of neuroscience and robotics to investigate human motor control, and to design efficient assistive devices and training systems for neuro-rehabilitation, which are tested in clinical trials and commercialized (e.g. gripable.co, Myro@tyromotion.com). In the last 3 years, he has attracted funding for over 3M£ from the UK EPSRC and the European Commission, and published over 25 papers in top robotics, neuroscience and rehabilitation technology journals. According to Google scholar, his papers have been cited over 15000 times, with an H-index of 58. Recent awards include a 2022 Eurohaptics Society award, the 2015 UK NHS Innovation Challenge Prize, the 2011 best paper award of the IEEE Transactions on Robotics, and the 2009 Apple Research & Technology Support award. Dr. Burdet's was a PI in 15 European FP7 and H2020 projects, currently in PH-CODING, INTUITIVE, REHYB, CONBOTS, NIMA. Alumni of his group (with 24 PhD students and 19 postdoctoral researchers) have taken faculty positions at leading universities and research institute such as ETHZ (Switzerland), Tokyo Institute of Technology (Japan), University of Waterloo (USA), Queen Mary University (UK), CNRS (France), ATR International (Japan), A*STAR (Singapore), and high-tech companies worldwide.

Education

84-90	Study of Mathematics and Physics at ETH-Zürich
89	Masters in Mathematics (thesis in Differential Geometry, advisor W Ballmann, U Bonn)
90	Masters in Physics (thesis in Computational Neuroscience, advisor K Hepp, ETH-Zürich)
91-96	PhD studies in Robotics at ETH-Zürich (advs: G Schweitzer, ETH-Zürich; T Flash, Weizmann Inst of Science)
97-99	Postdoctoral education in Computational Neuroscience and Haptics (with TE Milner, McGill, Canada; M Kawato, ATR, Japan; JE Colgate, Northwestern U, USA)

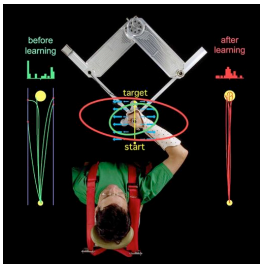
Languages: Studied and worked in French (mother tongue), German and English

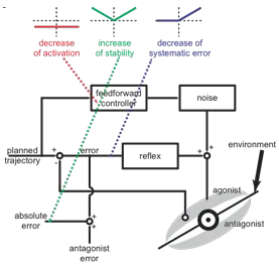
Professional experience

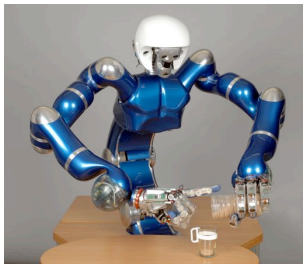
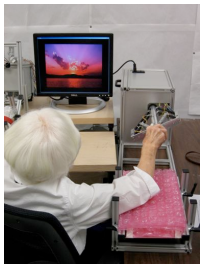
2005-	Imperial College London, Professor and Chair in Human Robotics since 2013
16-18	Invited Professor, Nanyang Technological University (NTU), Singapore
2012-	Honorary Professor, University College London (UCL)
09-16	Invited Professor, Sorbonne Université, France
7-8.12	Invited Professor, EPFL, Switzerland
09-11	Consultancy for A*STAR, Singapore
05-08	Senior Fellow, National University of Singapore (NUS)
99-04	Assistant Professor, National University of Singapore
98-08	Consultancy for ATR International, Japan
96-99	Postdoctoral Fellow, Simon Fraser U, Canada, and Northwestern U, USA
6-8.96	Visiting Researcher, Fujitsu Ltd, Numazu, Japan
91-96	Research Assistant at the Institute of Robotics, ETH-Zürich, Switzerland

Awards

2015	(UK) National Health System Innovation Challenge Prize
2012	Best IROS Jubilee Video Award, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS is one the two dominant robotics conferences)
2011	IEEE Transactions on Robotics Best Paper Award (TRO is the top robotics journal)
2010	Best Paper Award, Asean Oceanian Congress of Physical and Rehabilitative Medicine
2009	Apple Research and Technology Support Award
2009	Best Presentation Paper Award at IEEE International Conference on Rehabilitation Robotics (ICORR) (from over 200 submissions)
2006	Best Application Paper Award at IROS (chosen from 2166 submitted papers)
2004	Tier II Canada Research Chair (to attract the best researchers with promise of significant potential) (http://www.chairs.gc.ca, the offer was declined)
2003	ATR Research Award (awarded to 4-5 people worldwide each year)
2001	Best Paper Award, Japanese Neural Networks Society (http://www.jnns.org)
1998	Advanced Researcher Award, Swiss National Science Foundations
1996	Prospective Researcher Award, Swiss National Science Foundations (see http://nfp.snf.ch/E/funding/individuals/mobility-fellowships)






Our interdisciplinary approach to **human interface** has generated significant achievements including:

- The first clear evidence and computational model of how humans learn appropriate force and impedance to control movements in unpredictable situations (Nature 414: 446-9, J Neuroscience 28(44): 11165-73, first two panels above from the left). This translated to the first nonlinear adaptive robot controller able to deal with unstable situations typical of tool use and interaction with soft environments, by learning appropriate force and mechanical impedance (2011 Best Paper Award, IEEE T Robotics).
- The first fMRI-compatible haptic interfaces, which are used in five labs in Japan and Europe in order to investigate the neural mechanisms of human motor control and rehabilitation.
- Robotic devices for decentralized rehabilitation of hand function, some of which are commercialised (fourth photo from the left; best paper award at IROS06, the dominant conference for robotics applications).
- A low-cost robotic wheelchair system based on path guidance assistance, which was shown to significantly reduce the control effort, and was tested by cerebral palsy and traumatic brain injury individuals.
- The first brain controlled wheelchair able to maneuver in a building environment (see right photo above).
- The first evidence and computational modeling of haptic communication (Nature Human Behaviour 1: 54).

Selected recent patents and journal publications

M Mace, JL Liardon, P Rinne, P Bentley and E Burdet (2015), A force measurement mechanism, UK patent 1500840.2.

A Allievi, T Arichi, AD Edwards and E Burdet (2015), Maturation of sensorimotor functional responses during the third trimester of human development. Cerebral Cortex 26 (1): 402-13.

M Mace, N Kinany, P Rinne, A Rayner, P Bentley and E Burdet (2017), Balancing the playing field: Collaborative gaming for training. Journal of NeuroEngineering and Rehabilitation 14: 116.

A Takagi, G Ganesh, T Yoshioka, M Kawato and E Burdet (2017), Physically interacting individuals estimate the partners goal to enhance their movements. Nature Human Behaviour 1: 54.

Y Li, G Ganesh, N Jarrassé, S Haddadin, A Albu-Schäffer and E Burdet (2018), Human-like interaction control for contact tooling and haptic identification. IEEE Transactions on Robotics 34(5): 1170-82.

S Dall'Orso, A Allievi, J Steinweg, D Edwards, E Burdet, T Arichi (2018), Somatotopic mapping of the developing sensorimotor cortex in the preterm human brain. Cerebral Cortex 28(7): 2507-15.

Y Li, G Carboni, F Gonzalez, D Campolo and E Burdet (2019), Differential game theory for versatile physical human-robot interaction. Nature Machine Intelligence 1: 36-43.

A Takagi, M Hirashima, D Nozaki and E Burdet (2019), Individuals physically interacting in a group rapidly coordinate their movement by estimating the collective goal. eLife 8: e41328.

C Mehring, M Akselrod, L Bashford, M Mace, ...A Serino and E Burdet (2019), Augmented manipulation ability in humans with six-fingered hands. Nature Communications 10(1): 2401.

A Takagi, M Hirashima, D Nozaki and E Burdet (2019), Individuals physically interacting in a group rapidly coordinate their movement by estimating the collective goal. eLife 8: e41328.

E Ivanova, G Carboni, J Eden, Jörg Krüger and E Burdet (2020), For motion assistance humans prefer to rely on a robot rather than on an unpredictable human. IEEE Open Journal of Engineering in Medicine and Biology 16(1): 133-9.

A Arami, H van der Kooij, E van Asseldonk and E Burdet (2020), A clustering-based approach to identify joint impedance during walking. IEEE Transactions on Neural Systems and Rehabilitation Engineering 28(8): 1808-16.

Y Huang, W Lai, L Cao, J Liu, E Burdet and SJ Phee (2021), A three-limb teleoperated robotic system with foot control for flexible endoscopic surgery. Annals of Biomedical Engineering 8: 1-5.

B Berret, A Conessa, N Schweighofer and E Burdet (2021), Stochastic optimal feedforward-feedback control determines timing and variability of arm movements with or without vision. PLoS Computational Biology 17(6): e1009047.

J Eden, M Bräcklein, ...E Burdet, C Mehring (2022), Principles of human movement augmentation and the challenges in making it a reality. Nature Communications 13(1): 1-3.