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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 5 years, he has attracted funding for over 3M£, and published over 75 papers in top robotics, neuroscience and rehabilitation technology journals. According to Google scholar, his papers have been cited over 23000 times, with an H-index of 69. Recent awards include 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 is or was a PI in 15 European FP7 and H2020 projects, and workpackage leader in two European COST Action networks. Alumni of his group (with over 30 PhD students and over 30 postdoctoral researchers) have taken faculty positions at leading universities and research institutes such as ETHZ (Switzerland), Tokyo Institute of Technology (Japan), University of Waterloo (Canada), King's College, Queen Mary, Manchester, Lancaster, Liverpool, Sussex and Cardiff 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)

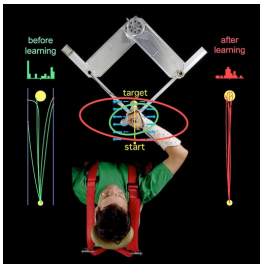
Languages: Studied and worked in French (mother tongue), German and English

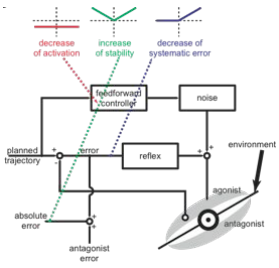
Professional experience

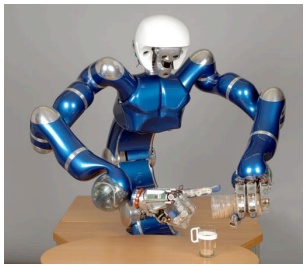
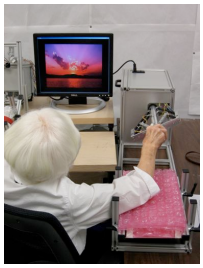
2005-	Imperial College London, Professor in Human Robotics since 2013
16-18	Invited Professor, Nanyang Technological University (NTU), Singapore
2012-	Honorary Professor, University College London (UCL)
09-16	Invited Professor, Sorbonne Université, France
7-8.12	Invited Professor, EPFL, Switzerland
09-11	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-machine interaction** has generated significant achievements including:

- The first clear evidence and computational model of how humans adjust muscle reciprocal and coactivation 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 Transacions on Robotics).
- 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 decentralised 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 (students in *italic*, * indicates authors with equal contribution)

CL Teo, *L Tong*, J Klein and **E Burdet** (2013), Therapy device for training fine motor skills. US patent 61/891959.

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

E Burdet, R Osu, *DW Franklin*, TE Milner and M Kawato (2001), The CNS skillfully stabilizes unstable dynamics by learning optimal impedance. Nature 414: 446-9.

DW Franklin, **E Burdet**, *KP Tee*, T Milner, R Osu and M Kawato (2008), CNS learns stable, accurate and efficient movements using a simple algorithm. Journal of Neuroscience 28(44): 11165-73.

Q Zeng, **E Burdet** and CL Teo (2009), Evaluation of a collaborative wheelchair system in cerebral palsy and traumatic brain injury users. Neurorehabilitation and Neural Repair 23(5): 494-504.

O Lambercy, L Dovat, H Yun, SK Wee, C Kuah, K Chua, R Gassert, TE Milner, CL Teo and **E Burdet** (2011), Robot-assisted rehabilitation of grasp and pronation/supination. Journal of NeuroEngineering and Rehabilitation 8: 63.

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.

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.

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.

L Cazenave, M Einenkel, A Yurkewich, S Endo, S Hirche and **E Burdet** (2023), Hybrid robotic and electrical stimulation assistance. IEEE Transactions on Neural Systems and Rehabilitation Engineering 31: 4063-72.

X Cheng, *S Shen*, E Ivanova, G Carboni, A Takagi and **E Burdet** (2025), Human impedance modulation to improve visuo-haptic perception. PLoS Computational Biology 21(5): e1013042.

L Johannsmeier, S Schneider, Y Li, **E Burdet** and S Haddadin (2025), A process-centric manipulation taxonomy for the organization, classification and synthesis of tactile robot skills. Nature Machine Intelligence 7(6): 916-27.

L Rebelo Dal'Bello, DJ Berger, D Borzelli, **E Burdet** and A d'Avella (2026), A modular architecture for trial-by-trial learning of redundant muscle activity patterns in novel sensorimotor tasks. PLoS Computational Biology (in press).

D Verdel, B Berret and **E Burdet** (2026), How individual vigor shapes human-human physical interaction. eLife 14: RP10978 (in press).