

7th

Graz

Brain-Computer Interface Conference



GRAZ BCI

FROM VISION TO REALITY

18-22 SEPTEMBER 2017
GRAZ, AUSTRIA



Institute of Neural Engineering  Graz University of Technology

Program Book



bci.tugraz.at



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Participants of the 6th Graz BCI Conference 2014

From Vision to Reality

We have chosen our this year's conference title to summarize the current situation of BCI research in a very brief statement. On the one hand, we see that some of our ideas are still visions, far from any applications. Basic research is the state of those visions and we still need to lay the foundation to transform those visions into working systems. On the other hand, we see that first BCI systems come to patients in clinics and that they are used on regular basis. However, it is important to discuss the needs in the BCI field to bring more of our ideas, our visions into reality. Is it research funding? Do we have too few people in the field? Is it too interdisciplinary? Do we need big industry partners? All these questions are vivid and need to be addressed to achieve progress in the field of BCI research. This 7th Graz Brain-Computer Interface Conference (GBCIC2017) offers the opportunity for extensive discussions and exchange of ideas among BCI experts from more than 30 countries. We received more than 100 scientific contributions from roughly 300 authors. The scientific contributions have been peer-reviewed by at least two reviewers and collected in this present open access ebook.

For the Conference itself, we have been able to setup a colorful and multifaceted program. We are very happy that the GBCIC2017 has been officially endorsed by the BCI Society and that we will have an official Meeting of the BCI Society at the Conference. Further, we are lucky that outstanding experts in the field, Dr. A Bolu Ajiboye (Case Western Reserve University, & Louis Stokes Cleveland VA Medical Center, Cleveland, OH, USA), Prof. Benjamin Blankertz (Technische Universität Berlin, Germany), Dr. Fabien Lotte (Inria Bordeaux Sud-Ouest, France), and Dr. Natalie Mrachacz-Kersting (Aalborg University, Denmark), accepted our invitation to present keynote addresses at the Conference. As a special keynote, we present Prof. Fred D. Davis (Texas Tech University, Rawls College of Business, USA). He is a senior researcher in the field of user acceptance of information technology, technology supported decision making, skill acquisition, and NeuroIS. With his talk he will make a link between the BCI field and his research disciplines. Additionally, we have several Satellite Events prior and after the Conference. New in the program: the BCI Science Slam, an event where researchers can present their work in an entertaining way. Finally, we end the GBCIC2017 with a tour to the South Styrian Vineyards, like we did in the past years.

We hope that this conference contributes towards a strong scientific cooperation among our field, and we wish all participants an exciting, stimulating and productive Graz BCI Conference 2017!



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Conference Chair

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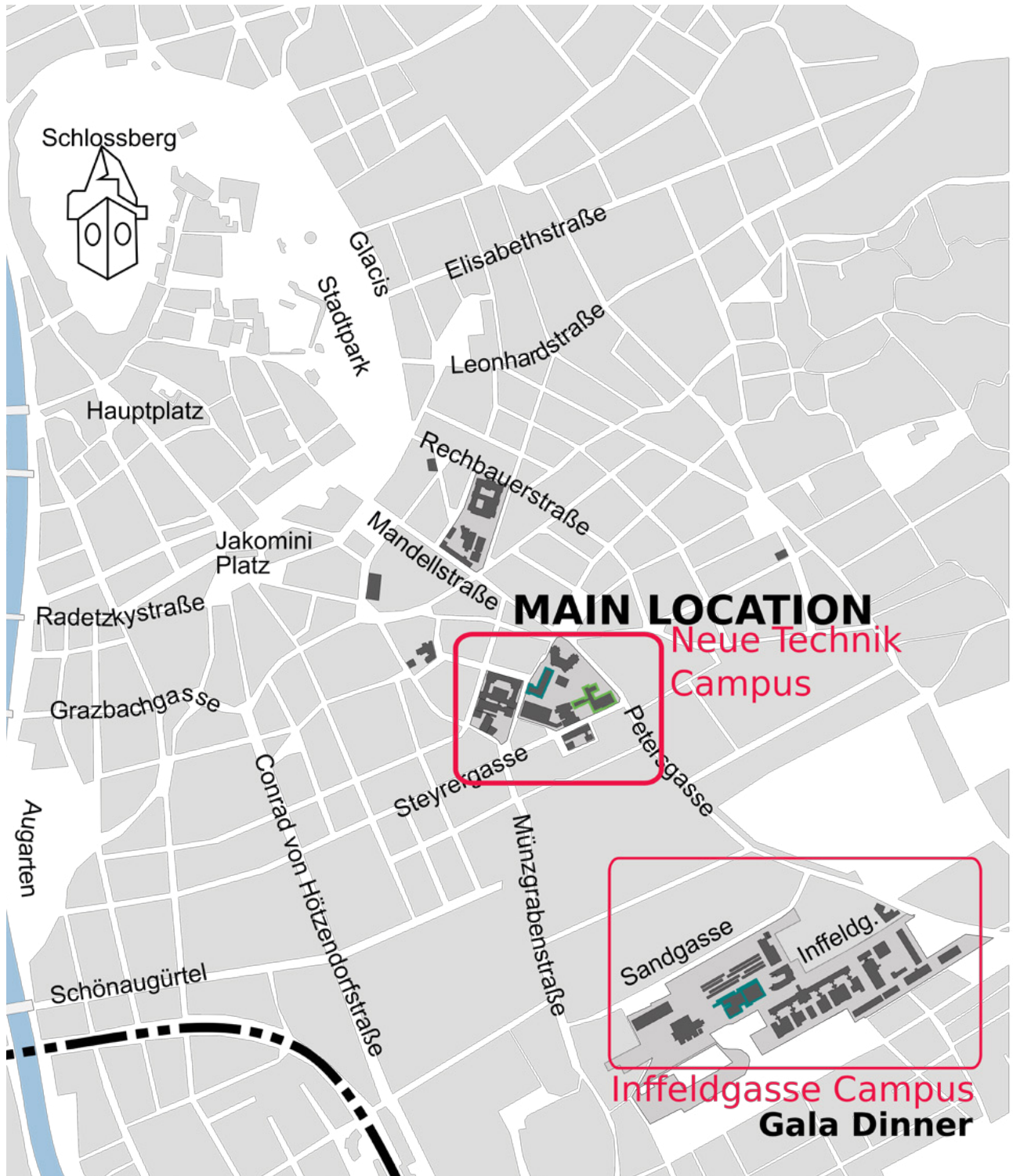
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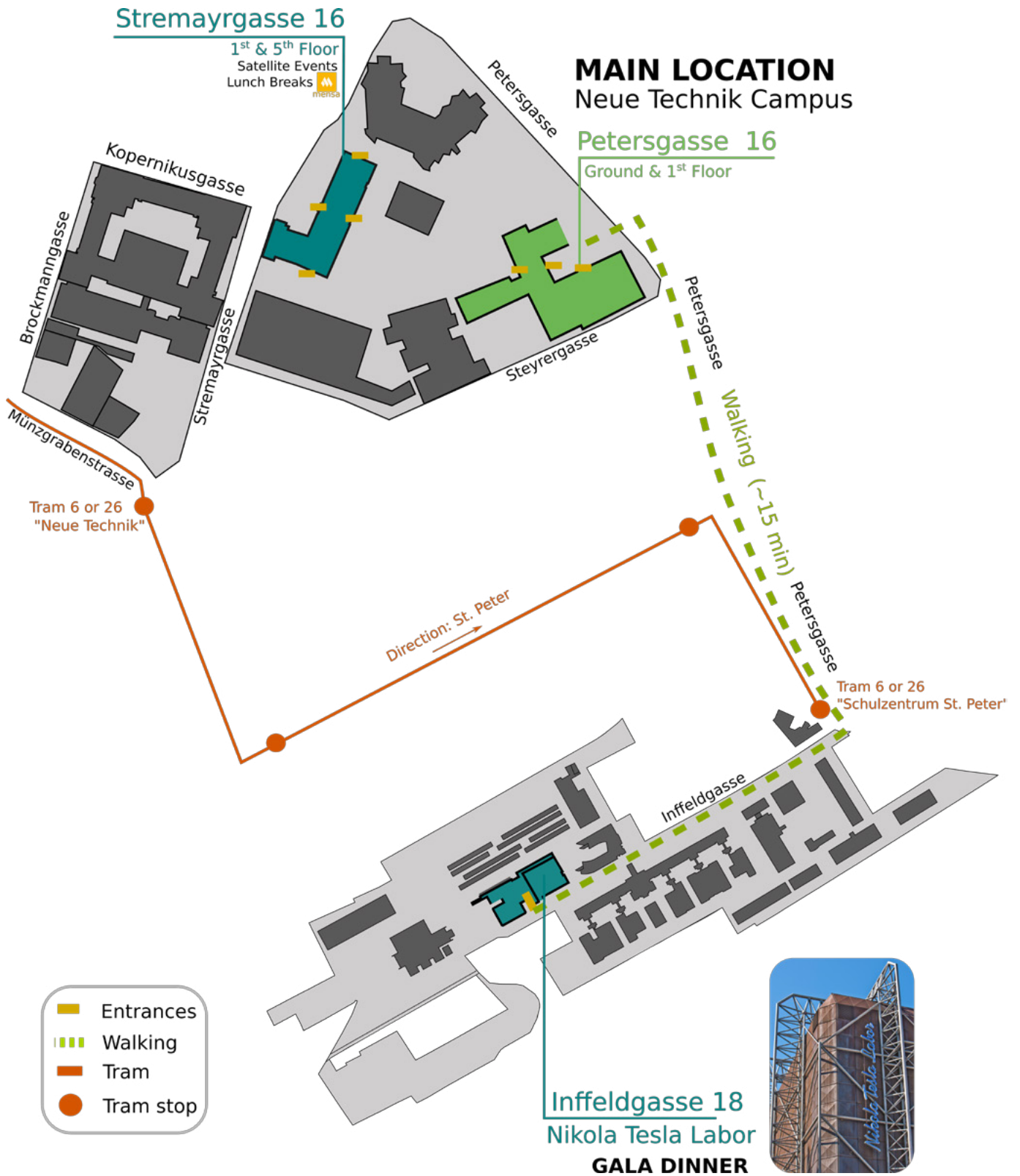
Schedule

Satellite events		Conference				
September 17	September 18	September 19	September 20	September 21	September 22	
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	
Stremayrgasse 16	Stremayrgasse 16	Petersgasse 16	Petersgasse 16	Petersgasse 16	Petersgasse 16	
Brain-Computer Interface Designers Hackathon <i>Room BMTeg038, Ground Floor</i>	Brain-Computer Interface Designers Hackathon	Registration 08:00	Registration 08:00	Registration 08:00	Registration 08:00	
	WS 1: Cloud-based BCIs: challenges and opportunities of home-use systems for big data collection <i>Room BMT03094, 3rd Floor</i>	Opening Ceremony 09:00	Prof. Benjamin Blankertz 09:15	Dr. Natalie Mrachacz-Kersting 09:15	Chill-Out Breakfast 09:00	
	WS 2: Facilitators and barriers of using mobile EEG: a workshop using the extreme test case of BCI for space flights <i>Room BMT01046, 1st Floor</i>	Dr. Fabien Lotte 09:30	Talks 10:00	Talks 10:00	Science Slam 10:00	
	WS 3: Passive BCI, Lab Streaming Layer and Neuroadaptive Technology <i>Room BMT01038, 1st Floor</i>	Talks 10:15	Talks 10:15	Talks 10:15	Awards & Closing Ceremony 11:00	
		Coffee Break 11:00	Coffee Break 11:00	Coffee Break 11:00		
		Talks 11:30	Talks 11:30	Talks 11:30		
		Talks 11:45	Talks 11:45	Talks 11:45		
		Talks 12:00	Talks 12:00	Talks 12:00		
		Talks 12:15	Talks 12:15	Talks 12:15		
		Talks 12:30	Talks 12:30	Talks 12:30		
		Talks 12:45	Talks 12:45	Talks 12:45		
		Lunch 13:00	Lunch 13:00	Lunch 13:00	Tour to the South Styrian Vineyards 14:00	
		Lunch 13:15	Lunch 13:15	Lunch 13:15	<i>Departure: Petersgasse 16</i>	
		Lunch 13:30	Lunch 13:30	Lunch 13:30		
		Lunch 13:45	Lunch 13:45	Lunch 13:45		
		Lunch 14:00	Lunch 14:00	Lunch 14:00		
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		Lunch 14:30	Lunch 14:30	Lunch 14:30		
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		Lunch 19:45	Lunch 19:45	Lunch 19:45		
		Lunch 21:00	Lunch 21:00	Lunch 21:00		
		Lunch 22:00	Lunch 22:00	Lunch 22:00		
		BCI Society Meeting <i>Room BMTeg138 (HS BMT) Ground Floor</i>	BCI Award 2017 Ceremony	Talks	Gala Dinner <i>Inffeldgasse 18</i>	
		BCI Society General Assembly <i>Stremayrgasse 16 Room BMTeg138 (HS BMT) Ground Floor</i>				
		Dr. A Bolu Ajiboye 16:45	Prof. Fred D. Davis 16:45	Talks		
		Talks 17:00	BCI Award 2017 Ceremony 17:00			
		Talks 17:15				
		Talks 17:30				
		Talks 17:45				
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		Talks 19:15				
		Talks 19:30				
		Talks 19:45				
		Talks 21:00				
		Talks 22:00				

Conference Venue



Conference Venue



Satellite Events

Brain-Computer Interface Designers Hackathon

Sunday, September 17, 8:00 - Monday, September 18, 16:30
Stremayrgasse 16, BMTEG038, ground floor

Inspired by the unique “Agent Unicorn” headpiece from Fashion-Technology- Artist Anouk Wipprecht (NL), this hackathon challenges young geeks to build and design a unique, playful and wearable headpiece which is able to measure useful EEG signals in real-time to create any sort of interaction.

With the intended purpose in mind, the teams plan and produce their own fully functional headpiece. 3D printers are on-site, so the teams will be able to give their headpieces an individual design that fits on participants' head. The goal of this hackathon is to bring people of different professions together, such as engineers, programmers, physicians, or graphic designers. As an interdisciplinary team, they learn from each other and merge well established hardware and software in order to create a new, innovative and exceptional idea. The participation only requires basic knowledge in Brain-Computer Interfaces, machine learning, programming, signal processing or designing.

BCI Society Meeting

Monday, September 18, 17:30
Stremayrgasse 16, room BMTEG138 (HS BMT), ground floor

BCI Society General Assembly

Tuesday, September 19, 18:15
Stremayrgasse 16, room BMTEG138 (HS BMT), ground floor

Opening Cocktail

Tuesday, September 19, 19:45
Stremayrgasse 16, 5th floor

Gala Dinner

Thursday, September 21, 19:45
Inffeldgasse 18

Chill-Out Breakfast and BCI Science Slam

Friday, September 22, 09:00
Petersgasse 16

Tour to the South Styrian Vineyards

Friday, September 22, 12:30
Departure: Petersgasse 16

Workshops

Cloud-based BCIs: challenges and opportunities of home-use systems for big data collection

Monday, September 18, 9:00 - 17:00

Stremayrgasse 16, room BMT03094, 3rd floor

Bringing brain-computer interfaces from the lab environment into the homes of patients and consumers requires three components: 1) Cloud-based realtime signal processing and machine learning that generalises across large datasets, 2) Low-cost, wireless EEG hardware with sufficient signal quality for scientific and clinical purposes, 3) User-friendly, cross-platform software applications to make the system directly accessible to endusers. Tackling this challenge may be the key to enabling robust communication and control for patients, and breaking the limitations of current research in terms of sample size and longitudinal data. With this workshop we aim to bring experts from both inside and outside the BCI community together to inspire future work that will allow us to overcome existing boundaries, both in research and in clinical practice.

Passive BCI, Lab Streaming Layer and Neuroadaptive Technology

Monday, September 18, 10:00 - 14:00

Stremayrgasse 16, room BMT01038, 1st floor

This workshop is aimed at participants interested in applications of BCI technology in Human-Computer Interaction for users without disabilities. It is intended to represent the Society for Neuroadaptive Technology (SNAT) and to support the communication between this society and BCI researchers. Dr. Thorsten O. Zander will present and discuss the aims of passive BCI research, Neuroadaptive Technology and modern Human-Computer Interaction. This part represents a forum to identify synergies and develop new ideas. Dr. David Medine and Ratko Petrovic, will present technological developments for passive and hybrid BCIs. Dr. Medine will present the LabStreamingLayer (LSL), an open-source software project for synchronized, multi-modal data streaming and recording. Mr. Petrovic will present recent hardware developments compatible with LSL. The third part is a hands-on demonstration with Neuroadaptive Technologies. In several groups, participants use an application combining passive BCI, gaze control and dry electrodes.

Facilitators and barriers of using mobile EEG: a workshop using the extreme test case of BCIs for space flights

Monday, September 18, 14:00 - 17:00

Stremayrgasse 16, room BMT01046, 1st floor

Since the advent of EEG in which the subject is mobile, facilitated by enabling technology available since 2013, an increasing number of application areas are opening up for investigation into cognitive, motor control and other neurological and behavioral processes outside of the lab in a realistic environment. While faced with new challenges compared to classical experiments in the lab, this has spread the use of EEG as a measuring method into Sports and Movement Science, Entertainment, Neuromarketing and even more fundamental Cognitive Neuroscience. During our workshop, expert speakers in their respective fields will touch upon the possibilities this new technology has enabled and also explain how one can perform ecologically valid experiments in less controlled environments. By the means of a group discussion we will try to identify which barriers still exist and what methods are being developed to aid in understanding the brain outside the confines of the lab.

Program

Tuesday, September 19

Paper no.

- 09:00 **Opening Ceremony**
- 09:15 **Keynote: Understanding and Improving BCI User Training to Boost Brain-Computer Communications**
Dr. Fabien Lotte
- 10:15 7 **Adaptive Spatial Filtering: Increasing the Effectiveness of Motor Imagery Based BCI**
Bartosz Binias
- 10:30 77 **No Training, Same Performance!? – a Generic P300 Classifier Approach**
Andreas Pinegger and Gernot R. Müller-Putz
- 10:45 78 **Approaches to Zero-Shot Stimulus Decoding in ECoG and Potential BCI Applications**
Christopher Ratto, Carlos Caceres, Matthew Roos, Kyle Rupp, Griffin Milsap, Nathan Crone and Michael Wolmetz
- 11:00 *Coffee Break*
- 11:30 75 **The PROMOTœR: a Successful Story of Translational Research in BCI for Motor Rehabilitation**
Floriana Pichiorri, Emma Colamarino, Febo Cincotti and Donatella Mattia
- 11:45 89 **EEG-Based Graph Theory Indices to Support the Clinical Diagnosis of Disorders of Consciousness**
Jlenia Toppi, Laura Astolfi, Monica Riseti, Rita Formisano and Donatella Mattia
- 12:00 52 **Error-Related Potentials with Masked and Unmasked Onset During Continuous Control and Feedback**
Catarina Lopes Dias, Andreea Ioana Sburlea and Gernot Müller-Putz
- 12:15 92 **Headgear for Mobile Neurotechnology: Looking into Alternatives for EEG and NIRS Probes**
Alexander von Lühmann, Surjo Soekadar, Benjamin Blankertz and Klaus-Robert Müller
- 12:30 69 **Vibro-Tactile Evoked Potentials for BCI Communication of People with Disorders of Consciousness and Locked-In Syndrome**
Rupert Ortner, Rossella Spataro, Josef Scharinger, Brendan Zachary Allison, Alexander Heilingner and Christoph Guger
- 12:45 *Lunch Break*
- 14:30 *Poster Session*
- 16:30 **Keynote: Re-thinking Paralysis: Brain Computer Interfaces and Functional Electrical Stimulation for Movement Restoration in Persons with Chronic Tetraplegia**
Dr. A. Bolu Ajiboye
- 17:30 30 **Investigating Music Imagery as a Cognitive Paradigm for Low-Cost Brain-Computer Interfaces**
Lukas Großberger, Matthias R. Hohmann, Jan Peters and Moritz Grosse-Wentrup
- 17:45 62 **MoreGrasp: Restoration of Upper Limb Function in Individuals with High Spinal Cord Injury by Multimodal Neuroprostheses for Interaction in Daily Activities**
Gernot Müller-Putz, Patrick Ofner, Andreas Schwarz, Joana Pereira, Granit Luzhnica, Cecilia di Sciascio, Eduardo Veas, Sebastian Stein, John Williamson, Roderick Murray-Smith, Carlos Escolano, Luis Montesano, Björn Hessing, Matthias Schneiders and Rüdiger Rupp
- Evening Break*
- 19:45 **Opening Cocktail**
Stremayrgasse 16, 5th floor

Program

Thursday, September 21

Paper no.

- 09:00 **Keynote: Development of an Associative BCI for the Restoration of Lost Motor Function**
Dr. Natalie Mrachacz-Kersting
- 10:15 87 **Using Recurrent Neural Networks for P300-Based Brain-Computer Interface**
Ori Tal and Friedman Doron
- 10:30 39 **Decoding of Walking Intention Under Lower Limb Exoskeleton Environment Using MRCP feature**
Ji-Hoon Jeong, No-Sang Kwak, Min-Ho Lee and Seong-Whan Lee
- 10:45 5 **Steady State Visual Evoked Potentials at the Boundaries of Visual Perception**
Gustavo Berumen and Tsvetomira Tsoneva
- 11:00 *Coffee Break*
- 11:30 14 **Brain Computer Interface Based Communication in the Completely Locked-In State**
Ujwal Chaudhary, Aygul Rana, Azim Malekshahi, Stefano Silvoni and Niels Birbaumer
- 11:45 4 **Electroencephalography (EEG)-Derived Markers to Measure Components of Attention Processing**
Alessandra Anzolin, Laura Astolfi, Jlenia Toppi, Angela Riccio, Floriana Pichiorri, Febo Cincotti and Donatella Mattia
- 12:00 90 **Utrecht Neuroprosthesis: from Brain Signal to Independent Control**
Max van den Boom, Meron Vermaas, Erik Aarnoutse, Sacha Leinders, Elmar Pels, Zac Freudenburg, Mariana Branco, Mariska Vansteensel and Nick Ramsey
- 12:15 32 **Tactile Brain-Computer Interface Control of a Mobile Platform in a Real World Environment Using a Low-Cost Electroencephalography Headset**
Sebastian Halder, Johanna Räderscheidt, Robin Heß, Daniel Eck, Klaus Schilling and Andrea Kübler
- 12:30 34 **A Pleasant Auditory Brain Computer Interface Using Natural Environment Sounds**
Minqiang Huang, Daly Ian, Xingyu Wang and Jing Jin
- 12:45 *Lunch Break*
- 14:30 *Poster Session*
- 16:30 65 **Yes or No? – Binary Brain-Based Communication Utilizing Motor Imagery and FNIRS**
Laurien Nagels-Coune, Denizhan Kurban, Niels Reuter, Amaia Benitez, Louisa Gossé, Lars Riecke, Rainer Goebel and Bettina Sorger
- 16:45 28 **Optimal Transport Applied to Transfer Learning for P300 Detection**
Nathalie T. H. Gayraud, Alain Rakotomamonjy and Maureen Clerc
- 17:00 37 **Mixing Two Unsupervised Estimators for Event-Related Potential Decoding: an Online Evaluation**
David Huebner, Thibault Verhoeven, Pieter-Jan Kindermans and Michael Tangermann
- 17:15 45 **Decoding Hazardous Events in Driving Videos**
Henrich Kolkhorst, Wolfram Burgard and Michael Tangermann
- 17:30 6 **Brain-Computer Interfacing with Emotion-Inducing Imagery: a Pilot Study**
Alain Desire Bigirimana, Nazmul H Siddique and Damien Coyle
- Evening Break*
- 19:45 **Gala Dinner**
Inffeldgasse 18

Program

Friday, September 22

- 09:00 **Chill-Out Breakfast**
- 10:00 **Science Slam**
- 11:15 **Awards and Closing Ceremony**
- 12:30 **Departure for the South Styrian Vineyards**



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Posters

Tuesday, September 19

Paper no.

- 2 **Detection of Attention Alteration of BCI Users Based on EEG Analysis**
Susan Aliakbaryhosseinabadi, Ernest Nlandu Kamavuako, Ning Jiang, Dario Farina and Natalie Mrachacz-Kersting
- 8 **Controlling False Positives on a BCI Implant for Communication**
Mariana Branco, Zachary Freudenburg, Elmar Pels, Sacha Leinders, Max van den Boom, Timothy Denison, Mariska Vansteensel, Erik Aarnoutse and Nick Ramsey
- 10 **SigViewer - Current Status and Recent Developments**
Clemens Brunner, Yida Lin, Paul Sajda and Josef Fallner
- 11 **Increasing Stroke Patients Motor Imagery Classification by Selecting Features with Particle Swarm Optimisation**
Jessica Cantillo-Negrete, Ruben I. Carino-Escobar, Paul Carrillo-Mora and Josefina Gutierrez-Martinez
- 12 **Closed-Loop Deep Brain Stimulation System for an Animal Model of Parkinson's Disease: A Pilot Study**
Sebastian Castaño-Candamil, Soheil Mottaghi, Volker A. Coenen, Ulrich G. Hofmann and Michael Tangermann
- 13 **Subspace Decomposition in the Frequency Domain**
Sebastian Castaño-Candamil and Michael Tangermann
- 20 **Time to Relax: No Effects to the Stress Response After Short-Term Use of a Brain-Computer Interface**
Amelia Cole, Bernhard Riecke and Alissa Antle
- 21 **Sensory Threshold Electrical Stimulation Enhances Classification of Motor Imagery**
Tiffany Corbet, Iñaki Iturrate, Michael Pereira, Serafeim Perdakis and José Del R. Millán
- 22 **Affective Brain Computer Music Interfacing: a Case Study of Use by an Individual with Huntington's Disease**
Ian Daly, Aileen Ho, Julien Marcon, Faustina Hwang, Duncan Williams, Alexis Kirke, Eduardo Miranda and Slawomir Nasuto
- 24 **Towards a Non-Invasive System for Trans-Humeral Amputee Motion Restoration**
Jacobo Fernandez-Vargas, Kahori Kita and Yu Wenwei
- 29 **How Many Electrodes Are Needed for Multi-Target SSVEP-BCI Control: Exploring the Minimum Number of Signal Electrodes for CCA and MEC**
Felix Gemler, Piotr Stawicki and Ivan Volosyak
- 36 **Challenging the Assumption That Auditory Event-Related Potentials Are Independent and Identically Distributed**
David Huebner and Michael Tangermann
- 38 **Preliminary Results of Testing a BCI-Controlled FES System for Post-Stroke Rehabilitation**
Danut Constantin Irimia, Marian Silviu Poboroniuc, Rupert Ortner, Brendan Zachary Allison and Christoph Guger
- 42 **Resting EEG-Based Subject Identification System: a Practical Scenario for Offline Analysis**
Donghyeon Kim and Kiseon Kim
- 43 **Aphasia Rehabilitation After Stroke – Why P300 Brain-Computer Interface (BCI) Training May Be Beneficial**
Sonja Kleih
- 47 **Online-Capable Cleaning of Highly Artefactual EEG Data Recorded During Real Driving**
Laurens R. Krol, Thorsten O. Zander, Matthew Jaswa, Oded Flascher, Anne Snelting and Anne-Marie Brouwer

Posters

Tuesday, September 19

Paper no.

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Tanja Krumpe, Katrin Baumgärtner, Wolfgang Rosenstiel and Martin Spüler
- 50 **Using a One-Dimensional Control Signal for Two Different Output Commands in an Implanted BCI**
Sacha Leinders, Elmar Pels, Mariska Vansteensel, Mariana Pedroso Branco, Zac Freudenburg, Max van den Boom, Meron Vermaas, Erik Aarnoutse and Nick Ramsey
- 53 **Online Classification Accuracy Is a Poor Metric to Study Mental Imagery-Based BCI User Learning: an Experimental Demonstration and New Metrics**
Fabien Lotte and Camille Jeunet
- 55 **Brain Activation Map During BCI Communication in Complete Locked in State**
Azim Malekshahi, Aygul Rana, Stefano Silvoni, Niels Birbamuer and Ujwal Chaudhary
- 57 **Tikhonov Regularization Enhances EEG-Based Spatial Filtering for Single-Trial Regression**
Andreas Meinel, Fabien Lotte and Michael Tangermann
- 60 **A Guided Task for Cognitive Brain-Computer Interfaces**
Julia Moser, Matthias Hohmann, Bernhard Schölkopf and Moritz Grosse-Wentrup
- 63 **Movement Decoding from EEG: Target or Direction?**
Gernot Müller-Putz, Lukas Peicha and Patrick Ofner
- 64 **Random Visual Evoked Potentials (RVEP) for Brain-Computer Interface (BCI) Control**
Sebastian Nagel, Wolfgang Rosenstiel and Martin Spüler
- 67 **Visual Input Affects the Decoding of Imagined Movements of the Same Limb**
Patrick Ofner, Philipp Kersch and Gernot Müller-Putz
- 71 **A Gaze-Independent Audiovisual Brain-Computer Interface and its Application in Awareness Detection**
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- 73 **Event-Related Potentials in Externally and Internally-Driven Target Selection: a Preliminary Study**
Joana Pereira, Andreea Ioana Sburlea and Gernot R. Müller-Putz
- 76 **PEANUT: Personalised Emotional Agent for Neurotechnology User-Training**
Léa Pilette, Camille Jeunet, Boris Mansencal, Roger N'Kambou, Bernard N'Kaoua and Fabien Lotte
- 85 **Comparison of Speed, Accuracy, and User Friendliness Between SSVEP-Based BCI and Eye-tracker**
Piotr Stawicki, Felix Gemblar, Abdul Saboor and Ivan Volosyak
- 88 **A SSVEP BCI based on Canonical Correlation Analysis**
Luca Talevi, Valeria Mondini, Anna Lisa Mangia, Maurizio Lannocca and Angelo Cappello
- 93 **Home Used, Patient Self-Managed, Brain Computer Interface for Treatment of Central Neuro-pathic Pain in Spinal Cord Injury: Feasibility Study**
Aleksandra Vuckovic, Manaf Kadum Hussein Al-Taleb, Mariel Purcell and Matthew Fraser
- 94 **Improving Classification Performance of a Brain-Computer Interface System Based on Rapid Serial Visual Presentation by Shifting Stimuli**
Dong-Ok Won, Han-Jeong Hwang, Klaus-Robert Müller and Seong-Whan Lee

Posters

Wednesday, September 20

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- 1 **Working Memory as a Control Signal in a Fully Implanted Brain-Computer Interface**
Erik Aarnoutse, Elmar Pels, Sacha Leinders, Zachary Freudenburg, Mariana Branco, Max van Den Boom, Timothy Denison, Mariska J Vansteensel and Nick Ramsey
- 3 **Investigating Written Text Readability for Passive BCI Based Neuroadaptive Speed Reading Applications**
Lena M. Andreessen, Peter Gerjets, Detmar Meurers and Thorsten O. Zander
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Fine Motor Control Achieved Through an Implantable Muscle Stimulator

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EEG-Based Classification of Multi-Class Emotional States Using One-Dimensional Convolution Neural Networks

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Brain Switch Mode: an Alternative to Drive a Brain-Controlled Wheelchair

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A Roadmap to Conquer BCI Illiteracy

Guilherme Wood, Silvia Kober, Matthias Witte

Neurofeedback-Based Tele-Rehabilitation

Silvia Erika Kober and Guilherme Wood

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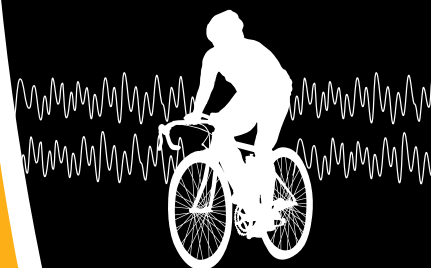


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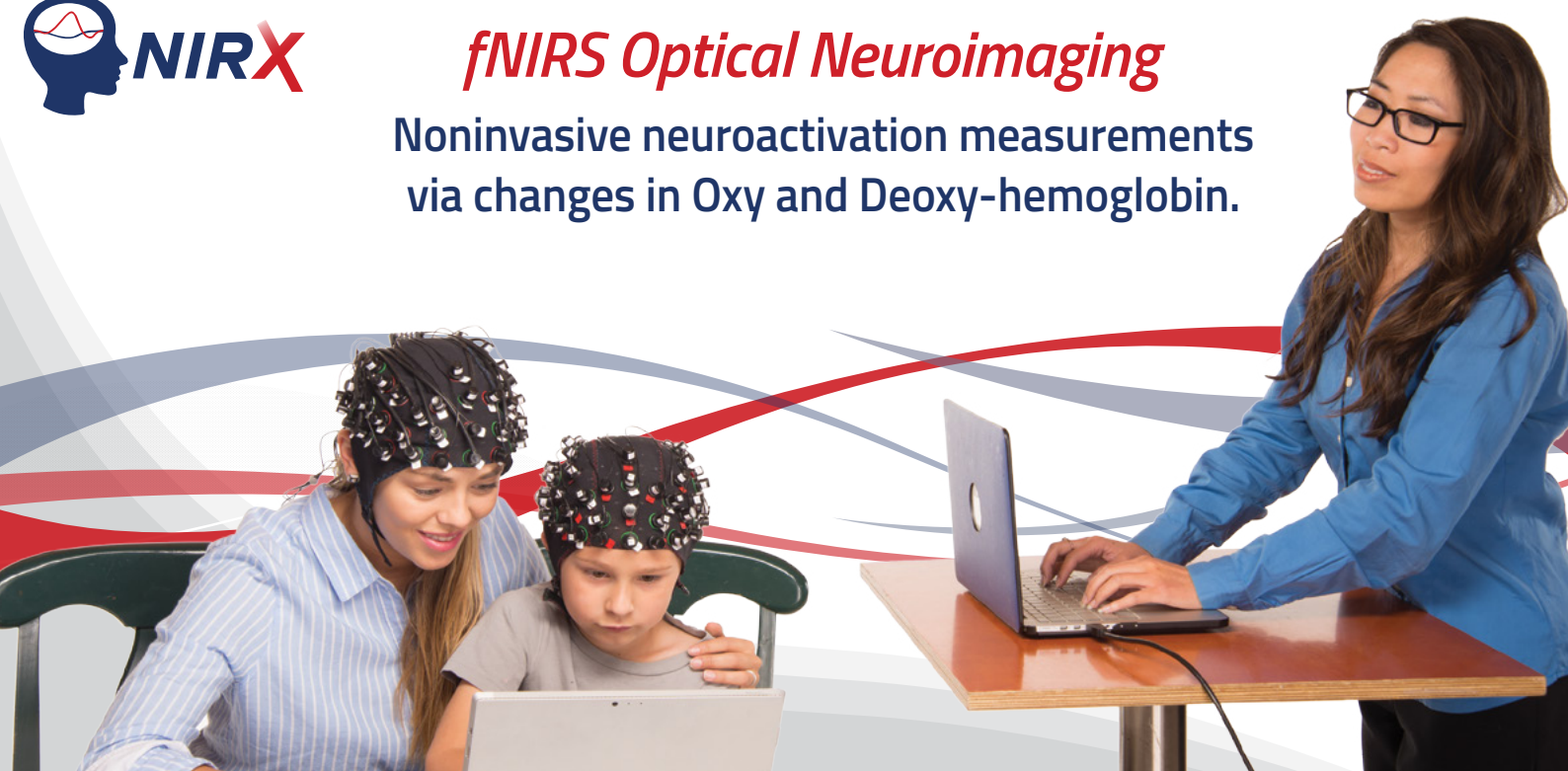
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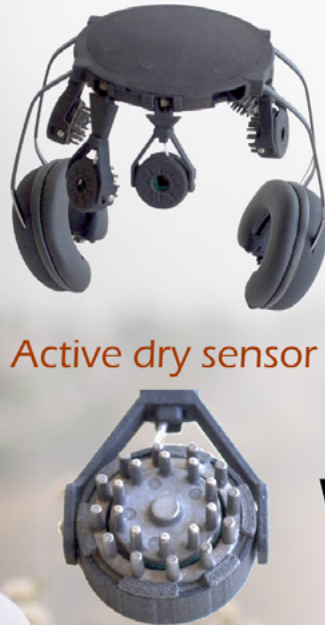
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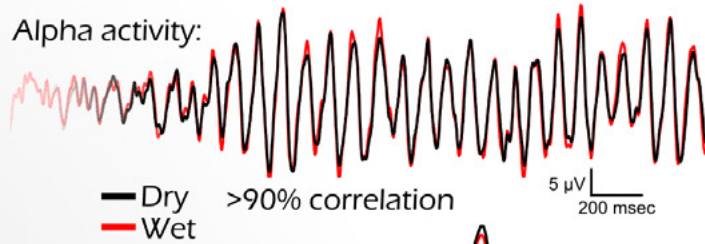
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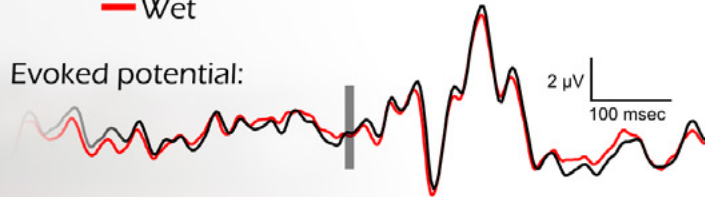
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