BCI SOCIETY

11th International BCI Meeting

June 2 - 5, 2025

Banff Centre for Arts and Creativity
Banff, Canada

@bcisociety.bsky.social
@BciSociety

#BCI2025

2025 BCI MEETING PROGRAM-AT-A-GLANCE

updated 05/23/2025

Time: 7:30, 7:45, 8:00, 8:15, 8:30, 8:45, 9:00, 9:15, 9:30, 9:45, 10:00, 10:15, 10:30, 10:45, 11:00, 11:15, 11:30, 11:45, 12:00, 12:15, 12:30, 12:45, 13:00, 13:15, 13:30, 13:45, 14:00, 14:15, 14:30, 14:45, 15:00, 15:15, 15:30, 15:45, 16:00, 16:15, 16:30, 16:45, 17:00, 17:15, 17:30, 17:45, 18:00, 18:15, 18:30, 18:45, 19:00, 19:15, 19:30, 19:45, 20:00, 20:15, 20:30, 20:45, 21:00, 21:15, 21:30, 21:45, 22:00, 22:15

Monday, June 2

Registration & Information Desk Open 7:30-18:00 (KC 100 Galleria Central)

Satellite Event: *From Innovation to Application: Advancing BCI Research & Development with g.tec*
Johannes Grünwald, Micah Ching, Christoph Guger
g.tec medical engineering GmbH
8:30 - 15:00
(KC 303)

Master Class 1
15:45-16:45
(KC 101, 103, 105, 210, 302, 303, 306, 308, 310)

Master Class 2
16:45 - 17:45
(KC 101, 103, 105, 210, 302, 303, 306, 308, 310)

Funding & Investment Panel
18:00 - 19:00
(Jenny Belzberg Theatre)

Dinner
19:00 - 20:00
(Vistas Dining Room)

Welcome, Town Hall & Tribute
20:15-21:15
(KC 101, 103, 105)

Bonfire Party
21:15-23:00
(*KC Patio*)

Tuesday, June 3

Registration & Information Desk Open 8:00-17:00 (KC 100 Galleria Central)

Breakfast
7:30 - 8:30
(Vistas Dining Room)

Plenary #1: *Adding the end-user to the design, development and evaluation of communication BCIs*
Melanie Fried-Oken
8:30 - 9:30
(Jenny Belzberg Theatre)

Workshop Session 1
9:45 - 12:45
(KC 101, 103, 105, 210, 302, 303, 306, 308, 310)

Lunch/Lunch with Leaders
12:45 - 13:45
(Vistas Dining Room)

Research Session 1
(Oral Presentations)
14:00 - 15:30
(KC 101, 103, 105)

Flash Talks (15 mins)

Posters &
Exhibitor Demonstrations
Session 1
15:45-17:45
(KC 201, 203, 205)

Global BCI Session
17:45 - 18:45
(KC 101, 103, 105)

Al-Fresco Dinner
19:00 - 23:00
(Mount View BBQ)

Wednesday, June 4

Registration & Information Desk Open 8:30-17:30 (KC 100 Galleria Central)

Breakfast
7:30 - 8:30
(Vistas Dining Room)

Neuroethics Session
8:30 - 9:30
(Jenny Belzberg Theatre)

Workshop Session 2
9:45 - 12:45
(KC 101, 103, 105, 210, 302, 303, 306, 308, 310)

Industry Insight Session:
Connexus® Brain-Computer Interface - From Design to Clinic
12:45 - 13:45

Nature Walks
14:00 - 16:00

Posters &
Exhibitor Demonstrations
Session 2
16:00 - 18:00
(KC 201, 203, 205)

BCI Users Forum
18:00 - 19:00
(KC 101, 103, 105)

Dinner
19:00 - 20:00
(Vistas Dining Room)

Plenary #2: *A neural manifold view of BCI decoding*
Juan Alvargo Gallego
20:15 - 21:15
(KC 101, 103, 105)

Bonfire Party
21:15-23:00
(*KC Patio*)

Thursday, June 5

Registration & Information Desk Open 8:30-17:30 (KC 100 Galleria Central)

Breakfast
7:30 - 8:30
(Vistas Dining Room)

Plenary #3: *Towards the goal of BCI control of upper limb prosthetics in the home environment*
Karunesh Ganguly
8:30 - 9:30
(Jenny Belzberg Theatre)

Workshop Session 3
9:45 - 12:45
(KC 101, 103, 105, 210, 302, 303, 306, 308, 310)

Lunch/Lunch with Leaders
12:45 - 13:45
(Vistas Dining Room)

Research Session 2
(Oral Presentations)
14:00 - 15:30
(KC 101, 103, 105)

Flash Talks (15 mins)

Posters &
Exhibitor Demonstrations
Session 3
15:45-17:45
(KC 201, 203, 205)

Early Career Awards
18:00 - 19:00
(KC 101, 103, 105)

Dinner
19:00 - 20:00
(Vistas Dining Room)

Closing Bonfire Party
20:00 - 23:00
(KC Patio)

Table of Content

Letter from the President

Dear Friends and Colleagues,

Welcome to the 11th International BCI Meeting! This year marks a special milestone for our community. The BCI Society was established in 2015, which means that we are celebrating its 10th anniversary! I am proud of the steps we have made towards a thriving, global and inclusive membership, while retaining the strong sense of community we all value so much.

The BCI field continues to be exciting and vibrant. Innovations in non-implanted and implanted recording technology, and rapid advances in algorithm development, are enhancing performance and applicability of BCI technology. These developments are driving progress towards real-world application of BCIs, accompanied by a growing recognition of the importance of incorporating end-user perspectives. Excitement about BCIs is also reflected in the expanding investments that are made in BCI companies, and in the increasing interest of the general public in BCI technology. The theme we have chosen for this 11th BCI Meeting, *"Building Momentum: Fostering Collaboration in BCI"*, underscores the value of bringing together academics, industry representatives, clinicians, end-users, ethicists, regulatory experts and other BCI stakeholders from all over the world. Through interaction and collaboration, we can seize the opportunities that are now arising in the field and drive responsible innovation of BCIs that provide real benefit in daily life.

The Scientific Program Committee has put together an inspiring program for you. Valued elements from earlier meetings have been retained, including Keynote Presentations, Workshops, Poster and Exhibitor Sessions, Research Sessions, a Funding and Investment Panel, a Users Forum and a Neuroethics Session. New program elements are the Global BCI session, which is dedicated to showcasing the work of BCI researchers from low- and middle-income countries and aims to promote diversity and interaction between BCI researchers globally, and the Industry Insight Session, which offers companies in the BCI space an opportunity to present their latest developments. The program also includes sessions dedicated to foster the career development of early career researchers, such as Master Classes, Lunches with Leaders and the Early Career Awards session. Finally, there will be plenty of opportunity for you to catch up with your BCI friends and to make new connections, during shared meals, bonfire parties and while enjoying the breathtaking nature around Banff during a walk.

We would like to thank the National Institutes of Health, National Science Foundation, Connected Minds, Tianqiao and Chrissy Chen Institute, the University of Calgary and Blackrock Neurotech for their grant support. With these funds, we are able to offer Early Career Travel Grants, Financial Hardship Grants and Family Care Grants to 66 attendees, and enable the panelists of the Users Forum and their families to attend the Meeting. In addition, a big thank you to all the sponsors of the meeting, and to all of you for joining us here in Banff and for contributing to this wonderful community.

I wish you a great meeting!

Mariska Vansteensel
President of the BCI Society

About the BCI Society

History

The Brain-Computer Interface (BCI) Society is a member driven organization with 450+ members located in over 24 countries around the world. The BCI Society was formally established on March 13, 2015 as an international organization that is legally based in the Netherlands.

Society Membership

Membership in the BCI Society is open to all scientists, principal investigators, post docs, and students from around the world involved in the many research and practical aspects of BCI research. We welcome all involved in BCIs, including engineers, doctors, therapists, business people and users of BCI technology.

Mission

The purpose of the BCI Society is "to foster research leading to technologies that enable people to interact with the world through brain signals."

To serve this purpose, it will:

- **Organize meetings**
- **Collaborate with other BCI-related organizations and individuals**
- **Share research and information among its members**
- **Provide BCI-related information and advice to scientific, technical, or clinical organizations, governmental or regulatory entities, scientific or popular media, and the general public**
- **Engage in other activities designed to achieve the central purpose of the Society**

Board of Directors

Officers

Mariska Vansteensel President	*University Medical Center Utrecht, the Netherlands*
Marc Slutzky Vice President	*Northwestern University, USA*
Gernot Müller-Putz Secretary/Treasurer	*Graz University of Technology, Austria*

Board Members

Abidemi Bolu Ajiboye	*Case Western Reserve University, USA*
Robert Gaunt	*University of Pittsburgh, USA*
Cuntai Guan	*Nanyang Technological University, Singapore*
Christian Herff	*Maastricht University, the Netherlands*
Dean J. Krusienski	*Virginia Commonwealth University, USA*
Betts Peters	*Oregon Health & Science University, USA*
Reinhold Scherer	*University of Essex, United Kingdom*
Davide Valeriani	*Technogym, United Kingdom*
Theresa Vaughan	*National Center for Adaptive Neurotechnologies, USA*

Ex-Officio member of the board

Jennifer Collinger
Past President — *University of Pittsburgh, USA*

BCI Meeting Executive Team

Robert Gaunt	Young Talent Committee
Eli Kinney-Lang	Scientific Program Committee Chair
Reinhold Scherer	Scientific Program Committee Chair
Marc Slutzky	Conference Co-Chair
Mariska Vansteensel	Conference Chair

BCI Society Administration

Cendrine De Vis	Senior Association Manager, *Podium Conference & Association Specialists*
Katherine Jolin	Conference Manager, *Podium Conference & Association Specialists*
Sebastien Lavoie	Conference Assistant, *Podium Conference & Association Specialists*
Tori Lunden	Junior Conference Manager, *Podium Conference & Association Specialists*

Association Secretariat & Conference Management: bci@podiumconferences.com

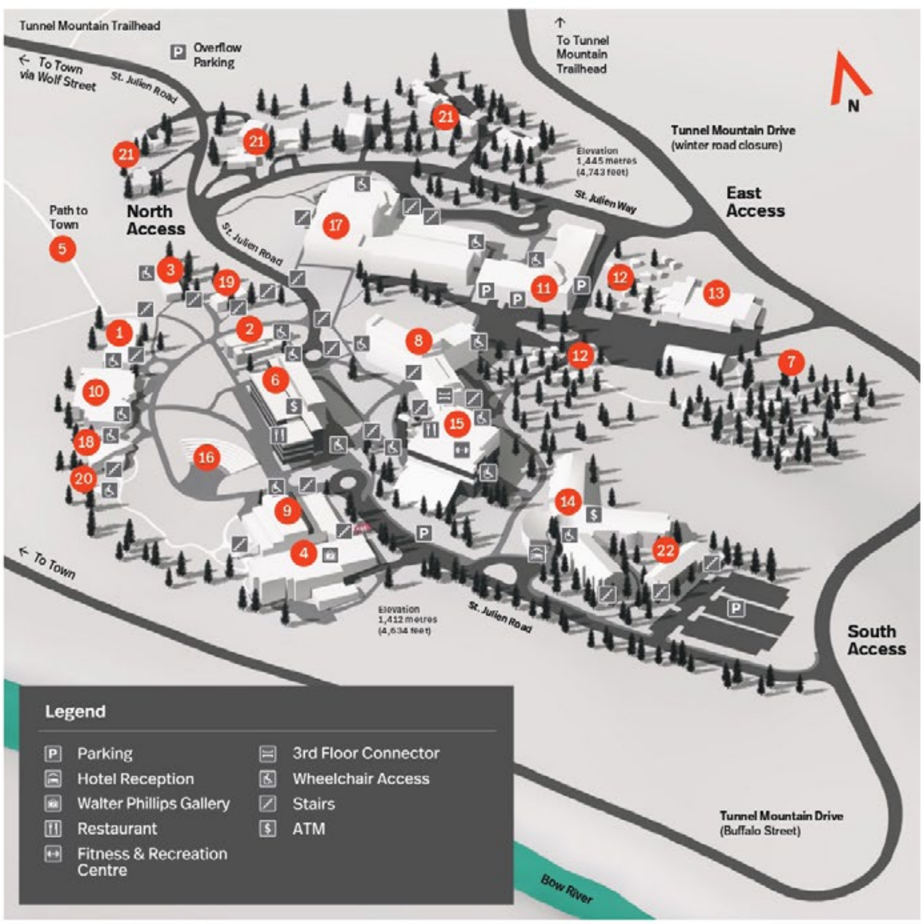
General Meeting Information

BCI Society Code of Conduct

The BCI Society Code of Conduct listed below reflects our Society's values and our expectations for Society members and guests. This Code of Conduct is in effect while at the International BCI Meetings and any social event linked to the BCI Society. Conduct should be free of biases regarding race, cultural background, religion (or lack thereof), country of origin, age, sex, sexual orientation, gender identity, disability, physical appearance, or other individual characteristics or expression. No harassment will be tolerated. Discussions should be respectful, civil, professional, and constructive reflecting tolerance for disagreements and recognition of opportunities to learn from each other. BCI Society has zero tolerance for sexual harassment including: any verbal or physical behavior that reflects unwelcome sexual advances, or behaving in any way that another individual feel impinges on their boundaries. If you are being harassed, notice that someone else is being harassed, or have any other concerns, please report it to us immediately. We value your attendance and will make every effort to ensure that you feel safe and welcome for the full duration of the Meeting. You can make a report by directly emailing Mariska Vansteensel, President and Marc Slutzky, Vice-President at codeofconduct@bcisociety.org.

Campus Map

banffcentre.ca | 403.762.6100



1. **Corbett Hall**
2. **Donald Cameron Centre**
   Administration Offices
3. **Farrally Hall**
4. **Glyde Hall**
   Walter Phillips Gallery
5. **Ken Madsen Path to Town**
6. **Kinnear Centre for Creativity & Innovation**
   Maclab Bistro
   Meeting Rooms & Banquets
   Paul D. Fleck Library & Archives
7. **Leighton Artist Studios**
8. **Lloyd Hall**
9. **Jeanne & Peter Lougheed Building**
10. **Max Bell Building**
11. **Music Building**
    Bentley Chamber Music Studio
    Rolston Recital Hall
12. **Music Huts**
13. **Physical Facilities Building**
    Print Shop
    Shipping & Receiving
14. **Professional Development Centre**
    Hotel Reception
15. **Sally Borden Building**
    Fitness & Recreation Centre
    Participant Resources
    Three Ravens Restaurant
    Vistas Dining Room
16. **Shaw Amphitheatre**
17. **Theatre Complex**
    Box Office
    Jenny Belzberg Theatre
    Laszlo Funtek Teaching Wing
    Margaret Greenham Theatre
18. **TransCanada PipeLines Pavilion**
    Banff International Research Station
19. **Vinci Hall**
20. **Yurt**
21. **Staff Housing**
22. **Staff Housing**
    Becker Hall

BANFF
CENTRE FOR ARTS AND CREATIVITY

Meeting Venue

Banff Centre is truly one of Canada's most unconventional venues for meetings. Hosting over 20,000 conference delegates from around the world every year, the Centre combines professional meeting facilities and breathtaking mountain vistas to create unforgettable experiences for attendees.

Conferences at Banff Centre provide delegates from all around the world with exceptional meeting facilities in an environment that fosters inspirational learning.

Meals

Eating together at **Vistas Dining Roo**m is an essential part of the BCI Meeting experience. The daily menu highlights fresh, seasonal, local produce sourced directly from regional farmers.

Vistas Dining Room set hours of operation are:

Breakfast:	7:30am – 9:30am
Lunch:	11:30am – 1:30pm
Dinner:	5:30am – 7:30pm

Need to grab and go? Visit the **Maclab Bistro**, open daily from 7:00am – 1:00am to savor nourishing and inventive comfort cuisine crafted from the finest local ingredients. Choose to dine in and relish your meal with a stunning view of the Bourgeau Range or opt for a convenient takeaway service. Podium staff will have vouchers available at the registration desk upon request.

Name Badges

Kindly wear your name badge at all times as your admission to the sessions, breaks and special functions such as the Bonfire Parties and the BBQ Dinner. At the end of the conference you are encouraged to recycle your badge at any of the recycle stations or at the registration desk.

Registration and Information Desk

The registration/information desk, located in **KC 100 Galleria Central**, is open daily during the following hours:

Monday, June 2	7:30am – 7:00pm
Tuesday, June 3	8:00am – 6:45pm
Wednesday, June 4	8:00am – 7:00pm
Thursday, June 5	8:00am – 7:00pm

Wireless Internet

Complimentary wireless internet is available to the delegates of the BCI Meeting at the Banff Centre for Arts & Creativity.

Please note that the WiFi provided is ideal for checking emails and websites, but is not strong enough for streaming videos or heavy social media use.

Photos

Make the most of your meeting experience by snapping and sharing your onsite photos! Whether it's a candid shot with colleagues, a speaker in action, or your favorite session moment — we want to see it all.

Share your photos on social media and tag us at #BCI2025 or upload your meeting photos here: BCI 2025 - Photos

Staff

Staff from Podium Conference Specialists can be identified by the orange border on their name badges. Feel free to ask any one of our staff for assistance or visit the registration desk.

Daily Schedule

Monday, June 2

8:30am - 3:00pm	*KC 303*		**SATELLITE EVENT**
			From Innovation to Application: Advancing BCI Research & Development with g.tec
		Speakers	**Johannes Grünwald**, *g.tec* **Micah Ching**, *g.tec* **Christoph Guger**, *g.tec*
3:45pm - 4:45pm			**Master Class Session 1**
	KC 101		**PhD Colloquium 1**
	KC 210		**Master Class 1** - *Speech Decoding*
	KC 302		**Master Class 2** - *Event Potentials & Artifacts*
	KC 303		**Master Class 3** - *Audio Machine Learning*
	KC 306		**Master Class 4** - *Spinal Cord Injury*
	KC 308		**Master Class 5** - *Motor Imagery*
	KC 310		**Master Class 6** - *BCI Platforms*
4:45pm - 5:45pm			**Master Class Session 2**
	KC 101		**PhD Colloquium 2**
	KC 210		**Master Class 7** - *Neural Mechanisms & Theory*
	KC 302		**Master Class 8** - *Brain Stimulation*
	KC 303		**Master Class 9** - *Cognition*
	KC 306		**Master Class 10** - *Patient Considerations*
	KC 308		**Master Class 11** - *Neurofeedback & Entrainment*
	KC 310		**Master Class 12** - *Decoding & Interaction*

Monday, June 2

6:00pm - 7:00pm	*Meeting room: KC 101, 103, 105*	**FUNDING & INVESTMENT PANEL**
	Moderator	**Marc Slutzky**, *Northwestern University Feinberg School of Medicine*
	Speakers	**Hannah Payette Peterson**, *Apollo Health Ventures* **Gillian Koehl**, *Advanced Research + Invention Agency (ARIA)* **Nick Langhals**, *National Institute of Neurological Disorders and Stroke (NINDS)* **Tyler Best**, *Advanced Research Projects Agency for Health (ARPA-H)*
7:00pm - 8:00pm	*Vistas Dining Room*	**DINNER**
8:15pm - 9:15pm	*KC 101, 103, 105*	**WELCOME, TOWN HALL & TRIBUTE**
	Speaker	**Mariska Vansteensel**, *BCI Society President*
9:15pm - 11:00pm	*KC Patio*	**BONFIRE PARTY** *sponsored by* NIRx ENLIGHTENING INNOVATION

Tuesday, June 3

7:30am - 8:30am	*Vistas Dining Room*	**BREAKFAST**
8:30am - 9:30am	*Jenny Belzberg Theatre*	**PLENARY TALK #1** ***Adding the End-User to the Design, Development and Evaluation of Communication BCIs*** **Melanie Fried-Oken**, *Ph.D., Oregon Health & Science University* *Sponsored by* TIANQIAO & CHRISSY CHEN INSTITUTE
9:45am - 12:45pm	*Multiple rooms*	**WORKSHOP SESSION 1** – For workshop details see page 26
	KC 306	**W1:** ***Expanding the experimental paradigms in enhancing BCI performance***
	KC 101	**W2:** ***Implanted Brain Computer Interface using real-time stimulation in the nervous system to restore movement and sensation: Clinical applications***
	KC 105	**W3:** ***Personalization of communication BCIs***
	KC 210	**W4:** ***Exploring the clinical integration of BCI technology in general anesthesia monitoring***
	KC 310	**W5:** ***How do we capitalize on today's implantable BCI hardware developments for tomorrow's BCI user lives***
	KC 303	**W6:** ***Clinical applications of Brain-Computer Interfaces in neurorehabilitation***
	KC 103	**W7:** ***AI + Data: Bridging AI expertise with BCI champions to advance AI innovation in BCIs***
	KC 308	**W8:** ***The global state of implantable Brain-Computer Interfaces: What should we do next?***
	KC 302	**W16:** ***Ethical considerations of participant engagement in long-term BCI clinical trials***
12:45pm - 1:45pm	*Vistas Dining Room*	**LUNCH/LUNCH WITH LEADERS**

Tuesday, June 3

2:00pm - 3:30pm *KC 101, 103, 105*

RESEARCH SESSION 1 (Oral Presentations)

Moderator **Gernot Müller-Putz**, *Graz University of Technology*

Presentations

Navigating the clinical trial pathway for implantable Brain-Computer Interfaces: The COMMAND study
Thomas Oxley, *Synchron*

The first BCI clinical trial for stroke neurorehabilitation in Latin America: The ReHand-BCI trial
Jessica Cantillo-Negrete, *Instituto Nacional de Rehabilitacion/National Institute of Rehabilitation*

Integrating BCI, FES, and social media for rehabilitation of upper extremity motor function in youth
Anna Bourgeois, *University of Calgary*

From ECoG signals to cervical epidural electrical stimulation: Restoring arm and hand movements after a spinal cord injury
Thibault Collin, *NeuroRestore*

Adaptive closed-loop neurofeedback Brain-Computer Interface for treatment of laryngeal dystonia
Jimmy Petit, *Harvard Medical School*

Advancing speech BCIs towards conversational speeds in people with paralysis
Kamran Hussain, *Stanford University*

3:30pm *KC 101, 103, 105*

FLASH TALKS SESSION 1

Moderator **Reinhold Sherer**, *University of Essex*

Presentations

µECoG Array with 3,072 electrodes for high-density and large-area cortical recordings based on scalable thin-film electronics
Paoline Coulson, *Katholieke Universiteit Leuven*

Mitigating EEG non-stationarity in multi-session MI BCI with autoencoder denoisers
Yoav Noah, *Ben-Gurion University*

Closed-loop error damping in human BCI using endogenous modifications in motor cortex activity
Nicolas Kunigk, *University of Pittsburgh*

Decoding of lower-limb movement intent from scalp electroencephalography (EEG) in children
Ayman Alamir, *University of Houston*

Tuesday, June 3

3:45pm - 5:45pm	*KC 201, 203, 205*	**POSTER & EXHIBITOR DEMONSTRATIONS SESSION 1**
5:45pm - 6:45pm	*KC 101, 103, 105*	**GLOBAL BCI SESSION**
	Moderator	**Victoria Peterson**, *Consejo Nacional de Investigaciones Científicas y Técnicas*
		Translational research in BCI for rehabilitation: Experiences from Argentina **Lucía Carolina Carrere**, *Ph.D., National University of Entre Ríos (FIUNER), Argentina*
		A decade of Brain-Computer Interface research at the National Institute of Rehabilitation in Mexico: Progress, challenges, and future directions **Jessica Cantillo-Negrete**, *Ph.D., National Institute of Rehabilitation Luis Guillermo Ibarra, Mexico*
		Advancing neurotechnology in Egypt: From constraints to contributions **Seif Eldawlatly**, *Ph.D., American University in Cairo, Egypt*
7:00pm - 11:00pm	*Mount View Barbecue*	**AL-FRESCO DINNER** *Sponsored by* synchron
		6:30pm **Pick-up:** Jenny Belzberg Theatre **Destination:** Mount View BBQ
		7:00pm **Pick-up:** Jenny Belzberg Theatre **Destination:** Mount View BBQ
		10:30pm **Return:** Mount View BBQ **Destination:** Banff Centre (Jenny Belzberg Theatre)
		11:00pm **Return:** Mount View BBQ **Destination:** Banff Centre (Jenny Belzberg Theatre)

Wednesday, June 4

7:30am - 8:30am	*Vistas Dining Room*	**BREAKFAST**
8:30am - 9:30am	*KC 101, 103, 105*	**NEUROETHICS SESSION**
	Introduction	**Robert Gaunt**, *University of Pittsburgh*
	Moderator	**Jutta Treviranus**, *OCAD University*
	Speakers	**Judy Illes**, *University of British Columbia*
		Jennifer French, *Neurotech Network*
		James Weiland, *University of Michigan*
		Sponsored by CONNECTED MINDS Neural and Machine Systems for a Healthy, Just Society
9:45am - 12:45pm	*Multiple rooms*	**WORKSHOP SESSION 2** For details, see page 30
	KC 303	**W9:** *Clinical translations of BCI: From lab to daily life*
	KC 101	**W10:** *Designing speech BCIs that facilitate good communication for users*
	KC 105	**W11:** *Toward theories of Brain-Computer Interaction*
	KC 306	**W12:** *Legal perspectives on BCIs: Navigating challenges from malfunctions to GDPR compliance and discrimination*
	KC 308	**W13:** *Stronger together: Harnessing the power of patient-partner engagement in BCI*
	KC 103	**W14:** *Brain-Computer Interface clinical trial design considerations and clinical outcomes assessments in pivotal studies*
	KC 310	**W15:** *Building a 5-year roadmap for implantable BCIs for pediatrics and pediatric onset-conditions*
12:45pm - 1:45pm	*KC 303*	**INDUSTRY INSIGHT SESSION**
		Connexus® Brain-Computer Interface – From Design to Clinic
	Speakers	**David Brandman**, *M.D., Ph.D, University of California, Davis*
		Daniel Rubin, *M.D., Ph.D., Massachusetts General Hospital*
		Matt Angle, *Ph.D., Paradromics, Inc.*
		Stephen Ryu, *M.D., Paradromics, Inc.*
		Vikash Gilja, *Ph.D., Paradromics, Inc.*
		Hosted & sponsored by Paradromics
12:45pm - 1:45pm	*Vistas Dining Room*	**LUNCH**

Wednesday, June 4

2:00pm - 4:00pm		**NATURE WALKS** Delegates have the opportunity to explore the Banff National Park on their own.
4:00pm - 6:00pm	*KC 201, 203, 205*	**POSTER & EXHIBITOR DEMONSTRATIONS SESSION 2**
6:00pm - 7:00pm	*KC 101, 103, 105*	**BCI USERS FORUM**
	Introduction	**Eli Kinney-Lang**, *University of Calgary*
	Moderator	**Ian Burkhart**, *BCI Pioneers*
	Speakers	**Payton Shaw**, *University of Calgary*
		Nina & Thomas Nagy
		Rennie & Tristan Froma
		Sponsored by iBCI-CC, University of Calgary
7:00pm - 8:00pm	*Vistas Dining Room*	**DINNER**
8:15pm - 9:15pm	*KC 101, 103, 105*	**PLENARY TALK #2**
	Moderator	**Robert Gaunt**, *University of Pittsburgh*
		A neural manifold view of BCI decoding **Juan Alvargo Gallego**, *Ph.D., Imperial College London* *Sponsored by* 脑虎 NeuroXess
9:15pm - 11:00pm	*KC Patio*	**BONFIRE PARTY** *Sponsored by* 脑虎 NeuroXess

Thursday, June 5

7:30am - 8:30am	*Vistas Dining Room*	**BREAKFAST**
8:30am - 9:30am	*Jenny Belzberg Theatre*	**PLENARY TALK #3:**
	Moderator	**Marc Slutzky**, *Northwestern University*
		Towards the goal of BCI control of upper limb prosthetics in the home environment
		Karunesh Ganguly, *M.D., Ph.D., University of California, San Francisco*
		sponsored by Blackrock Neurotech
9:45am - 12:45pm	*Multiple rooms*	**WORKSHOP SESSION 3** for details, see page 34
	KC 101	**W17:** *Invasive Brain-Computer Interfaces using neuromodulation for clinical applications*
	KC 302	**W18:** *Building consensus on implant targeting strategies for intracortical sensorimotor Brain- Computer Interfaces*
	KC 303	**W19:** *Exploring features to improve BCI: Challenges and opportunities*
	KC 105	**W20:** *Towards restoring speech and non-verbal communication with Brain-Computer Interfaces*
	KC 103	**W21:** *Large neural data models for Brain-Computer Interfaces*
	KC 306	**W22:** *Stimulate the senses to increase performance: The importance of afference in restorative Brain-Computer Interfacing*
	KC 308	**W23:** *Reaching consensus on BCI scientific reporting*
	KC 210	**W24:** *Engaging communities that produce commercial reports and analyses about BCIs*
12:45pm - 1:45pm	*Vistas Dining Room*	**LUNCH / LUNCH WITH LEADERS**
2:00pm - 3:30pm	*KC 101, 103, 105*	**RESEARCH SESSION 2** (Oral Presentations)
	Moderator	**Reinhold Sherer**, *University of Essex*
	Presentations	***Speech decoding performance is influenced by perceiving auditory feedback or not: Implications for locked-in individuals***
		Anouck Schippers, *UMC Utrecht Brain Center*

Thursday, June 5

	Presentations	***Combatting percept adaptation to intracortical microstimulation in humans*** **Taylor Hobbs**, *University of Pittsburgh*
		The variability of EEG spectral measures in MCS: Towards a multidimensional characterization of the awareness fluctuations **Ilaria Quattrociocchi**, *Sapienza University of Rome*
		Star-Burst paradigm: Implementation of an "invisible" dry-EEG reactive BCI **Jules Gomel**, *Institut Supérieur de l'Aéronautique et de l'Espace*
		An evoked potential of vection using passive Brain-Computer Interfaces **Gael Van Der Lee**, *Université de Lille*
		Long-term stability and performance of stimulation and recording in a human participant over 2,800 days **David Bjånes**, *California Institute of Technology*
3:30pm	*KC 101, 103, 105*	**FLASH TALKS SESSION 2**
	Moderator	**Gernot Müller-Putz**, *Graz University of Technology*
	Presentations	***Decoding of directional auditory attention shifts in multi-talker environments using EEG alpha power*** **Gabriel Ivucic**, *Universität Bremen*
		Decoding gestures from intracortical neural activity in ventral precentral gyrus **Elizaveta Okorokova**, *University of California, Davis*
		A multifunctional speech and movement intracortical Brain-Computer Interface for communication **Samuel Nason-Tomaszewski**, *Emory University and Georgia Tech*
		Bimanual BCI: Combining a brain-controlled hand exoskeleton with the functional limb **José Del R. Millán**, *University of Texas at Austin*
3:45pm - 5:45pm	*KC 201, 203, 205*	**POSTER & EXHIBITOR DEMONSTRATIONS SESSION 3**

Thursday, June 5

6:00pm - 7:00pm *KC 101, 103, 105*

EARLY CAREER AWARDS

Moderator **Theresa Vaughn**, *Samuel Stratton VA Medical Center*

Presentations

An accurate and multi-modal intracortical speech BCI

Sergey Stavisky, *University of California, Davis*

Investigating brain interactions: A dual path to understanding and improving BCIs

Marie-Constance Corsi, *Institut National de Recherche en Informatique et en Automatique*

Sponsored by CHEN TIANQIAO & CHRISSY INSTITUTE

7:00pm - 8:00pm *Vistas Dining Room*

DINNER

8:00pm - 11:00pm *KC Patio*

CLOSING BONFIRE PARTY

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Featured Sessions

Monday, June 2

FUNDING AND INVESTMENT PANEL

This panel session aims to introduce key funding bodies and investment entities supporting innovation in the Brain-Computer Interface (BCI) space. Panelists will present their organizations and highlight relevant funding and collaboration opportunities, with a focus on early-career researchers looking to establish or expand their work, including through international partnerships. In addition to practical insights into securing support, the session will feature a discussion on transitioning from academia to industry, offering guidance on how to align research with market needs and attract investor interest.

Tuesday, June 3

PLENARY TALK #1 - *Adding the end-user to the design, development and evaluation of communication BCIs*

In this plenary session, Dr. Fried-Oken will argue that our communication brain-computer interfaces (cBCIs) must be designed and evaluated based on principles for end-user involvement. She will share the podium with 4 people who rely on assistive technology for communication and were interviewed about their experiences and opinions regarding R&D for cBCIs. Together, they lay the foundation for collaborative, iterative development that is driven by the values of augmentative & alternative communication (AAC), user-centered design, and participatory action research.

Melanie Fried-Oken, *Ph.D., Oregon Health & Science University*

Melanie Fried-Oken, PhD is professor of Neurology, Pediatrics, Biomedical Engineering and Otolaryngology at the Oregon Health & Science University in Portland, Oregon USA. Melanie is an internationally recognized speech-language pathologist and clinical researcher in the area of Augmentative and Alternative Communication (AAC) and assistive technology. She is a fellow of the International Society for Augmentative and Alternative Communication (ISAAC) and the American Speech-Language-Hearing Association (ASHA). She is a Principal Investigator in CAMBI.tech (Consortium for Accessible Brain-Body Interfaces) and has led a federally funded multidisciplinary wearable BCI team for the past 15 years. Melanie's work is based on the tenet that communication is a basic human right. CAMBI's research agenda is guided by clinical interactions with people who experience severe speech and physical impairments and cannot find tools or techniques to express themselves adequately. The end-users and their families are members of the research teams that design and evaluate new technologies, including wearable communication BCIs.

supported by CHEN INSTITUTE TIANQIAO & CHRISSY

GLOBAL BCI SESSION

Translational research in BCI for rehabilitation: Experiences from Argentina

We are the Group of Rehabilitation Engineering of the Faculty of Engineering, National University of Entre Ríos in Argentina (1). Our work focuses on developing and clinically evaluating real-time, closed-loop brain-computer interfaces (BCIs) for motor and cognitive recovery in the clinical setting. This presentation provides an overview of our experience in translating BCI research from the laboratory to the clinical practice in Argentina. Our first BCIs were based on event-related desynchronization of movement attempt with functional electrical stimulation (FES) and intended for motor rehabilitation. In 2014, we conducted our first preliminary clinical study and evaluated the effect of using BCI for upper limb motor rehabilitation of stroke patients. In 2018, we conducted a second clinical study for gait rehabilitation of people with multiple sclerosis. Both studies involved 24 sessions with BCI and the functional scales after the therapy showed motor improvement (2,3). In 2022, we developed a new BCI for motor rehabilitation, IM-tention, which included functional electrical stimulation and visual feedback related to the motor function (4).

Lucía Carolina Carrere, *Ph.D., National University of Entre Ríos (FIUNER), Argentina*

Dr. Lucía Carolina Carrere is a researcher and educator in the field of Bioengineering at the Faculty of Engineering at the National University of Entre Ríos (FIUNER), Argentina. She holds a Ph.D. in Engineering with a specialization in Bioengineering and is currently an Associate Professor in the Department of Mathematics and Physics at FIUNER. Since 2010, she is a member of the Group of Rehabilitation Engineering at the Center for Neuromuscular Rehabilitation and Research, FIUNER, where she has led numerous research projects aimed at developing innovative BCI technologies for motor and cognitive rehabilitation. Her experience includes the design and implementation of experimental protocols for BCI evaluation, signal analysis of electroencephalography, and the translation of BCI technology into clinical practice. Her recent work includes studies of hybrid BCIs for attention training and integration of functional electrical stimulation for motor recovery, including evaluation of usability and acceptability of these systems. Her goal is to foster collaboration and innovation in the application of BCI technologies for improved patient care and rehabilitation outcomes. She is passionate about advancing neurorehabilitation and is committed to sharing her expertise in the BCI field with the goal of inspiring fellow researchers and practitioners in the field.

A decade of brain-computer interface research at the National Institute of Rehabilitation in Mexico: Progress, challenges, and future directions

Since 2015, the National Institute of Rehabilitation in Mexico City has led pioneering efforts in brain–computer interface (BCI) research for neurorehabilitation under the direction of Dr. Jessica Cantillo-Negrete. This research has produced the first randomized clinical trials of BCI-based therapy for upper extremity rehabilitation in stroke and spinal cord injury patients in Latin America. Through these studies, hundreds of therapy sessions have been delivered at no cost to patients, demonstrating the feasibility and clinical potential of BCI systems in real-world rehabilitation settings. Despite persistent challenges, including limited funding and societal skepticism regarding the role of science in public health, this work has established a foundation for enhancing access to advanced neurorehabilitation technologies in Mexico.

Jessica Cantillo-Negrete, *Ph.D., National Institute of Rehabilitation Luis Guillermo Ibarra, Mexico*

Dr Jessica Cantillo-Negrete is a Researcher in Medical Sciences and Head of the Technological Research Subdirection at the National Institute of Rehabilitation Luis Guillermo Ibarra Ibarra, Mexico City, Mexico. She completed her MSc and PhD degrees at CINVESTAV, also in Mexico City. Jessica is a leader in Brain-Computer Interface research in Mexico, having led a multidisciplinary team for nine years that has developed and applied this technology for neurorehabilitation. Her team has performed the first publicly funded Brain-Computer Interface clinical trials for stroke and spinal cord injury rehabilitation in Mexico and Latin America. She has also received funding from the Royal Society and the Newton Fund of the United Kingdom for establishing international collaborations aimed at the development of Brain-Computer Interfaces. Jessica has been recognized as a National Researcher by the Mexican government since 2016 and is a Mentor in Science certified by the British Council, having participated in mentorship programs aimed at the professional career development of Mexican women in the STEM fields. She has published 30 journal articles and has been supervisor of 18 graduate and postgraduate students. She has published scientific dissemination papers in Mexican journals that explain Brain-Computer Interfaces and their applications to the Spanish-speaking population. Her main objective is that her research has a positive impact on the health and quality of life of patients with neurological disabilities.

Advancing neurotechnology in Egypt: From constraints to contributions

Brain-Computer Interfaces (BCIs) hold transformative potential, offering unprecedented opportunities to improve quality of life through neuroengineering and artificial intelligence. Despite significant global advancements, researchers in low- and middle-income countries face unique challenges. This talk highlights my journey establishing impactful neurotechnology-related research in Egypt, focusing on key innovations such as EEG-based smartphone interactions, visual prostheses optimization, deep learning for neural signal analysis, and neurodegenerative diseases diagnosis. This talk emphasizes strategies that have enabled these research successes and underscores the importance of empowering diverse researchers to ensure inclusive innovation and global advancement in the BCI field.

Seif Eldawlatly, *Ph.D., American University in Cairo, Egypt*

Dr. Seif Eldawlatly is a Professor of Artificial Intelligence and Neural Engineering in the Computer Science and Engineering Department at the American University in Cairo (AUC), and the Computer and Systems Engineering Department at Ain Shams University, Cairo, Egypt. He earned his Ph.D. in Electrical Engineering from Michigan State University, USA, in 2011, following his M.Sc. and B.Sc. degrees in Electrical Engineering from Ain Shams University, Egypt, in 2006 and 2003, respectively. His research spans Neural Engineering, Brain-Computer Interfaces (BCIs) and Artificial Intelligence, with a focus on developing machine learning and signal processing techniques for invasive and non-invasive BCI applications, neuroprosthetics, and visual prostheses. Dr. Eldawlatly has served as principal investigator on multiple significant research projects, including developing mobile BCI applications for people with disabilities, visual prosthetic systems for vision restoration through electrical stimulation, and exploring neural markers for early diagnosis of neurodegenerative diseases. He has authored over 80 peer-reviewed publications, including journal articles, book chapters, and conference papers, in prominent scientific outlets. He has secured research funding from several international and national agencies, including The African Engineering and Technology Network, National Academy of Sciences (USA), Science and Technology Development Fund (Egypt), Google through a Google Faculty Research Award, and the Information Technology Industry Development Agency (Egypt).

Wednesday, June 4

NEUROETHICS SESSION

As brain-computer interfaces continue to advance in clinical research and commercial settings, ethical challenges surrounding device abandonment are becoming increasingly important to consider. This panel will draw on the expertise of ethicists, researchers, and individuals with lived experience to examine multiple dimensions of abandonment in both invasive and non-invasive BCIs, including ethical, clinical, and market considerations. Particular attention will be given to defining different forms of abandonment, exploring unique challenges for implanted systems, addressing disparities faced by users in underserved or remote areas, and navigating the tension between innovation and long-term user welfare. The session will include brief panelist introductions, a moderated discussion centered on key ethical questions, and a dedicated audience engagement segment designed to promote active participation of the meeting attendees. This dialogue aims to inform more responsible approaches to the design, regulation, and deployment of neurotechnologies in an evolving and uncertain environment.

Sponsored by: CONNECTED MINDS
Neural and Machine Systems for a Healthy, Just Society

INDUSTRY INSIGHT SESSION

Connexus® Brain-Computer Interface – From Design to Clinic

Join Paradromics for lunch and a deep dive into the design rationale, pre-clinical data, and clinical study plans for the Connexus Brain-Computer Interface (BCI). Building on 30 years of BCI research, this session explores the design, manufacture, and material choices behind this intracortical BCI, engineered for durability and high performance. Pre-clinical data, demonstrating longevity and record-breaking information capture rates, will be shared, as well as adverse events, challenges, and key learnings. The planned clinical trial will also be discussed, including an overview of the protocol, surgical technique, and timeline.

Hosted & sponsored by: Paradromics

USERS FORUM

The User Forum is a cornerstone reflecting the goals of the BCI Society Meeting. It is instrumental in creating productive interactions and transdisciplinary collaborations essential to continued, meaningful progress in the field of BCI. The User Forum brings current BCI users and persons with lived and living experience together into a focused discussion of topics unique to their experience - from priority user goals and challenges, to caregiver training and reimbursement, to system design and development. This year we have the additional privilege to be joined in the forum by several families whose children are pioneers in the quickly evolving world of pediatric BCIs, who will be sharing their unique experiences and adding to the rich history of the forum.

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iBCI-CC

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PLENARY TALK #2 - *A neural manifold view of BCI decoding*

Brain-computer interfaces (BCIs) have afforded paralysed users “mental control” of computer cursors and robots, or even of electrical stimulators that allow them to grasp objects or walk again. This control is typically achieved by mapping the activity of hundreds of motor cortical neurons recorded with implanted electrodes into appropriate control signals. Albeit impressive, these BCIs still face several challenges including: providing stable control over long periods of time, allowing users to perform a wide range of behaviours, and the need for them to be tailored for each user.

I will discuss how the combination of theoretical advances in systems neuroscience with statistical methods and neural network architectures are helping to overcome these challenges. I will focus on how the view that the collective activity of populations of single neurons may form the fundamental basic computational unit in the brain has allowed to build decoders that are stable over long time periods and that work across individuals, and how it is beginning to enable generalisation across actions. Combined with ongoing developments in bioelectronics and neural interfaces, these advances may foster the development of new generation of neuroprosthetic treatments for neurological disorders.

Juan Gallego, *Ph.D., Imperial College London*

Dr Juan Gallego is a Senior Lecturer (roughly equivalent to Associate Professor) and Group Leader in the Department of Bioengineering at Imperial College London, which he joined in January 2020. Dr Gallego’s research focuses on understanding how animals learn and control their movements through a combination of behavioural experiments, large-scale neural recordings, data analysis, and computational models. He is also interested in applying his group’s findings to advance neural interfaces that restore function to people with movement disorders. During his career, he has published more than thirty journal articles on these various topics, and received funding by the EU Commission, the UK Research Institutes, and the European Research Council.

Sponsored by:

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Thursday, June 5

PLENARY TALK #3 - *Towards the goal of BCI control of upper limb prosthetics in the home environment*

Brain-computer interfaces (BCIs) have enabled individuals with paralysis to control assistive technologies such as robotic limbs, yet achieving reliable, long-term use in real-world home environments remains a major challenge. In this presentation, I will describe our efforts toward stable, long-term BCI control of a wheelchair-mounted Kinova Jaco arm and hand. We address three key challenges: (1) maintaining stable BCI control over time, (2) understanding internal brain states during use in naturalistic settings, and (3) integrating computer vision to support object interaction. Using ECoG-based BCIs, we observed representational drift across days; by accounting for this drift with generalizable decision boundaries, we enabled consistent long-term neuroprosthetic control. We also identified slow (~0.1–0.4 Hz) fluctuations in high-gamma and beta-band activity during active BCI use, independent of task cues. These rhythms correlated with decoding accuracy and were anticorrelated with pupil diameter, suggesting modulation by arousal-linked internal states. Finally, we integrated computer vision tools to support object detection and interaction, which significantly improved functional performance. Together, these findings establish a systems-level framework for robust, adaptive, and context-aware BCI control – hopefully bringing us a step closer to practical neuroprosthetic use.

Karunesh Ganguly *MD, PhD, University of California, San Francisco*

Karunesh Ganguly MD, PhD is a clinical neurologist and a research scientist at the University of California, San Francisco and the San Francisco VA Medical Center. He completed his MD/PhD degrees through the Medical Scientist Training Program at the University of California, San Diego. He subsequently completed his internal medicine and neurology residency at the University of California, San Francisco. Concurrent with his residency, he conducted research into the development of 'Brain-Machine Interfaces' in the Department of Electrical Engineering & Computer Science at UC Berkeley. His clinical expertise is on the neurological rehabilitation of patients with motor impairments. He is also the Director of the Neural Engineering & Plasticity Lab. The laboratory's basic and translational research program focuses on the development of technology to improve motor function. His laboratory's work is funded by the NIH/NINDS/NICHD and the VHA. He has been awarded the Presidential Early Career Award for Scientists and Engineers (PECASE Award) and was selected for a New Innovator Award by the NIH Office of the Director. He was also recent awarded the Outstanding Neurorehabilitation Clinical Scientist Award by the American Society of Neurorehabilitation (ASNR).

Sponsored by: Blackrock Neurotech

An accurate and multi-modal intracortical speech BCI

Restoring communication has long been a goal of BCI research; today, this dream is on the verge of fruition with ongoing commercial cursor and click BCI clinical trials. I will describe our development of an intracortical speech BCI, which is the next frontier in restoring communication. First, we built a 99% word accuracy "brain-to-text" speech BCI. To this core capability, we've added neural cursor control over the participant's personal computer (despite recording from orofacial cortex). We've also augmented text decoding with a loudness layer and a gesture (emoji) layer, both of which provide added expressivity, and we prototyped a neural error decoder which can reduce user frustration. Lastly, I'll describe our progress towards an instantaneous voice synthesis BCI aimed at functionally replacing the paralyzed vocal system.

Sergey D. Stavisky, *PhD, University of California, Davis*

Sergey is a neuroscientist and neural engineer working at the intersection of systems and computational neuroscience, neural engineering, and machine learning. Trying to understand how the brain controls movements, and to use this knowledge to build brain-computer interface (BCIs) that treat brain injury and disease, Sergey's immediate goals are to develop BCIs for restoring speech. Closely related, he is developing next-generation neural interfaces for human use.

As an Assistant Professor in the Department of Neurological Surgery at the University of California, Davis, Sergey co-directs the UC Davis Neuroprosthetics Lab. Prior to that, he was a postdoctoral fellow in the Stanford Neural Prosthetics Translational Laboratory led by Jaimie Henderson and Krishna Shenoy. A neuroscientist and neural engineer working at the intersection of systems and computational neuroscience, neural engineering, and machine learning, Sergey is trying to understand how the brain controls movements and to use this knowledge to build brain-computer interfaces (BCIs) that treat brain injury and disease. His immediate goals are to develop BCIs for restoring speech. Closely related, he is developing next-generation neural interfaces for human use.

Investigating brain interactions: A dual path to understanding and improving BCIs

Despite promising technological advancements, Brain-Computer Interfaces (BCIs) still face challenges due to inter- and intra-subject variabilities in the ability to control such systems. Moreover, the neural mechanisms underlying BCI performance and training remain poorly understood. In this talk, I will present our recent findings on the use of brain interactions in BCIs, and in particular, how this enriched information can be used to both understand and improve BCIs.

Marie-Constance Corsi, *Institut National de Recherche en Informatique et en Automatique*

Marie-Constance Corsi is an early-career researcher who began a tenured research position at Inria in 2022, joining the NERV team at the Paris Brain Institute (France). After completing her studies in telecommunications engineering at IMT Atlantique (Brest, France), she pursued a PhD focused on developing alternative magnetoencephalography sensors—optically pumped magnetometers—at CEA-LETI (Grenoble, France), while concurrently earning a Master's degree in Clinical Neuroscience.

In 2016, she began postdoctoral research at the Paris Brain Institute, where she developed computational methods using multimodal and longitudinal approaches to improve brain-computer interfaces (BCIs). Her current work focuses on identifying neurophysiological markers of BCI performance to enhance classification accuracy and on developing tools for the monitoring and diagnosis of neurological disorders.

She previously served as Secretary General of CORTICO, the French academic association promoting advances in BCI, and as Co-Chair of the Postdocs and Students Committee of the BCI Society.

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Workshops

Tuesday, June 3

9:45am - 12:45pm

SESSION 1

W1: *Expanding the experimental paradigms in enhancing BCI performance*

Presenters

- **Lin Yao,** *Zhejiang University*
- **Jianjun Meng,** *Shanghai Jiao Tong University*
- **Ning Jiang,** *Sichuan University*
- **Xiaokang Shu,** *Shanghai Jiao Tong University*
- **Liming Zhao,** *Shanghai Jiao Tong University*
- **Guanye Li,** *Shanghai Jiao Tong University*
- **Gan Huang,** *Shenzhen University*

BCI is a promising technology that has demonstrated abundant exciting demos and clinical translation possibilities in recent years. However, many challenges still need to be resolved before BCI could be translated into clinical treatment and daily life augmentation. Experimental paradigms are increasingly important in enhancing BCI performance, e.g., inducing sensory information in motor imagery. This session highlights the importance of expanding traditional experimental paradigms to enhance BCI performance. For example, visual and peripheral sensory information contributes up to 80% to control muscle activation. Following central nervous system lesions, the lack of this feedback leads to a decline in the ability of patients to perform daily activities.

In this workshop, we will present and discuss various experimental paradigms that enhance the role of feedback from vision, auditory, and skin receptors for human movement. We will then demonstrate, using specific examples, how adding this feedback as part of a BCI may benefit the decoding and rehabilitation process and increase the effectiveness of BCIs designed for rehabilitation and augmentation of movement. Moreover, we will show and quantify the potential benefit of integrating visual information, peripheral tactile information for the novel BCI designation, and ways to improve the BCI performance.

W2: *Implanted Brain Computer Interface using real-time stimulation in the nervous system to restore movement and sensation: Clinical applications*

Presenters

- **Tetiana Aksenova,** *Commissariat à l'Énergie Atomique et aux Énergies Alternatives*
- **Henri Lorach,** *University of Lausanne*
- **Robert Gaunt,** *University of Pittsburgh*
- **Giacomo Valle,** *Chalmers University of Technology*
- **Solaiman Shokur,** *Scuola Sant'Anna Superiore Pisa*
- **Lucas Struber,** *Commissariat à l'énergie atomique et aux énergies alternatives*

Brain Computer Interfaces (BCIs) using real-time, closed loop stimulation of the nervous system aim to restore natural movements and sensations in individuals with severe motor disabilities. Contrary to open-loop stimulation, responsive closed-loop stimulation is driven by the direct or indirect action of the brain, synchronizing cortical commands with the stimulation of the individual's own neural pathways. Closed-loop stimulation of the nervous system is a promising approach to restore body functions and facilitate rehabilitation. With a high temporal and spatial resolution of the brain neuronal activity recording, invasive BCIs are particularly effective in achieving the synchronization necessary to produce a wide range of natural (realtime, low latency) movements or sensations with stimulation. Stimulation can be applied at various points along the neural pathway, including muscles, nerves, spinal cord, or directly on the cortex. This workshop will provide a comparative discussion of these techniques, examining their purposes, advantages, and disadvantages in movement and sensation restoration and rehabilitation. We invite dialogue between research teams working with implanted closed-loop BCIs and neurostimulation at different levels of the neural pathway.

W3: *Personalization of communication BCIs*

Presenters

- **Betts Peters,** *Oregon Health and Sciences University (OHSU)*
- **Jessie Liu,** *University of California, San Francisco*
- **Nicholas Card,** *University of California, Davis*
- **Tab Memmott,** *Oregon Health and Sciences University (OHSU)*

With the proof-of-concept phase completed for communication BCIs (cBCIs), we now must transition towards offering systems to users who present with different expectations, conditions, skills and needs. This next stage of development requires personalization of cBCI parameters, whether they be features for generating messages with language models, customized voice output, complex speech decoding, or creative interfaces (i.e., RSVP keyboards, avatars) that are sensitive to sensory, motor or cognitive skills of users. This workshop is uniquely positioned to address the skills and needs that users bring to BCI tasks and how technical software and user interface features affect optimal communication performance. We will ask questions about what optimal communication performance is and how we measure it when determining the best parameters for each user. Regardless of whether a user is participating in implantable or non-implantable BCI trials, software features and parameterization have a cost. Determining the cost versus benefit is important to all who engage with the process. Using clinical and technical experience, we will discuss what benefits or hinders our ability to add more critical features. What features are considered essential by the workshop attendees who have experience with personalization, end-user performance and user satisfaction?

W4: *Exploring the clinical integration of BCI technology in general anesthesia monitoring*

Presenters

- **Sébastien Rimbert,** *Institut National de Recherche en Informatique et en Automatique*
- **Sebastian Halder,** *University of Essex*
- **Bjørn Erik Juel,** *Vestre Viken Health Trust and University of Oslo*
- **Valerie Marissens Cueva,** *Institut National de Recherche en Informatique et en Automatique*

This workshop will explore the state-of-the-art applications of Brain-Computer Interfaces (BCI) in general anesthesia monitoring. BCIs offer the potential to improve patient care by providing direct neural feedback, giving clinicians real-time insights into brain activity during anesthesia through EEG-based tools to monitor awareness and the depth of anesthesia. We will focus on integrating BCIs in clinical settings, emphasizing how they can enhance anesthesia precision and enable more individualized care. Following brief introductions and discussions of relevant research methodologies and empirical findings (i.e., neural markers of awareness, machine learning tools, experimental protocols to study depth of anesthesia, etc.), we aim to open a dialogue on the implications of BCIs in the operating room and their potential to transform general anesthesia practice. In particular, better monitoring through BCIs could significantly reduce the incidence of intraoperative awareness, a rare but serious complication where patients regain consciousness during surgery. Participants will gain an understanding of the technical challenges, ethical considerations, and potential clinical benefits of employing BCIs for anesthesia monitoring. The workshop will provide a platform for cross-disciplinary discussion, inviting contributions from experts in neurotechnology, anesthesiology, and clinical practice to advance the state of knowledge in this rapidly evolving field.

W5: *How do we capitalize on today's implantable BCI hardware developments for tomorrow's BCI user lives*

Presenters

- **Martin Schuettler,** *CorTec GmbH*
- **Jonas Zimmermann,** *ABILITY Neurotech*
- **Erik Aarnoutse,** *University Medical Center Utrecht*
- **Phoenix Peng,** *NeuroXess*

Brain-Computer interfaces for people who will benefit from our technology consist of three parts: hardware, algorithms and user actuation/interaction. The academic community set all three parts in motion. Commercial entities are now largely responsible for the availability of the hardware, whereas algorithms and user actuation/interaction is still mostly in the academic realm. As a community we are in an interesting time where technology readiness level 9 (actual system proven in operational environment) for BCIs is on the horizon. How do we go from here to bring the technology to the home of the user? Will commercial entities enter the second and third part of a BCI? In this workshop profit/non-profit organizations are showcasing their new products, ready to go into early feasibility studies, and are commenting on their journey towards a fully implantable BCI solution. They will present their rationale for starting this journey and their vision of the future direction of implantable BCIs. After these presentations, the audience is divided into groups with mixed background and expertise to discuss scenario's for the near and far future, inspiring new design input, alliances and hopefully clinical trials.

W6: *Clinical applications of Brain-Computer Interfaces in neurorehabilitation*

Presenters

- **An Do,** *University of California, Irvine*
- **Zoran Nenadic,** *University of California, Irvine*
- **Charles Liu,** *Keck School of Medicine of USC*
- **Scott Stanslaski,** *Medtronic*
- **Nicole Stanchina,** *Medtronic*
- **Doug Atkins,** *Medtronic*

BCIs may be a promising tool for rehabilitation, whether as a tool for neuromodulation or as a prosthetic. The process of translating ideas into viable medical devices has many obstacles that need to be overcome. This workshop will survey the current state of BCI clinical applications, their promises and pitfalls, and generate consensus on future directions. Short lectures will cover topics on unmet clinical needs in clinical rehabilitation, engineering challenges that need to be overcome in order for practical deployment of BCIs, and putting BCIs in the context of other rehabilitation treatments and emerging treatments, e.g., standard physiotherapies, neuromodulation, and regenerative medicine. This workshop will provide background on the clinical translational process, including the regulatory and clinical trial process for invasive and non-invasive BCIs, and medical device economics. Building on these fundamentals, small and large group discussions will be undertaken, facilitated by the panelists, to discuss important open questions on clinical BCI applications. Each small group will discuss their findings with the larger group to develop a compilation of consensus statements and outstanding matters. The workshop's ultimate aim is to facilitate the field to successfully develop BCI-based clinical applications that will serve as meaningful treatment options for unmet neurorehabilitation needs.

W7: *AI + Data: Bridging AI expertise with BCI champions to advance AI innovation in BCIs*

Presenters

- **Eli Kinney-Lang,** *University of Calgary*
- **Ali Etemad,** *Queen's University*
- **Matthias Dold,** *Radboud University*
- **Hatem Abou-Zeid,** *University of Calgary*

Advancements in artificial intelligence (AI), machine learning (ML), and big data have moved at lightspeed over the past two years, with an explosion of interest in topics such as foundational models (FMs), large language models (LLMs), AI Agents, and generative AI models. These tools have the potential to transform BCIs in their development and application. However, the diverse impact potential of BCIs for a variety of populations, including extremely vulnerable populations, require critical and careful consideration when developing relevant AI and ML models and tools. This workshop aims to bring together those who have extensive knowledge in the advancing AI space, with those who have substantial and unique data together, to build a collaborative approach to the ethical development of these tools. Through a "Literal Data Blitz", where Data Champions and AI Experts are paired together in a speed-dating format, we will build the foundations for understanding how to develop and use advanced AI techniques to improve BCI systems as a community.

W8: *The global state of implantable Brain-Computer Interfaces: What should we do next?*

Presenters

- **Ian Burkhart,** *BCI Pioneers*
- **Jamie Brannigan,** *Oxford University Hospital*
- **K. Michelle Patrick-Krueger,** *Texas Institute of Restorative Neurotechnologies*
- **Jose Contreras-Vidal,** *University of Houston*

Implanted Brain-Computer Interfaces (iBCI) are progressing quickly, with over 25 years of research on long-term electrode implantation for communication and motor control applications. Despite this progress, as of December 2024, no iBCI systems have U.S. Food and Drug Administration approval, nor are they validated as lifelong solutions. A significant barrier to further advancement is the limited availability of comprehensive data on past and ongoing clinical trials. To bridge this gap, we reviewed all identified clinical trials of iBCIs for communication and motor control or restoration of tactile perception conducted with long-term electrode implantation occurring before October 2024, identifying key research groups, implanted participants, and devices used. A critical next step is establishing a registry of iBCI users, capturing their long-term outcomes and diverse experiences. This registry could be a vital resource, advancing research and fostering ethical, standardized approaches for clinical measures in iBCI studies. In this workshop, we will propose action items, including developing this registry, promoting governed data sharing, and fostering inclusivity in participant populations, clinical measures, and team science.

W16: *Ethical considerations of participant engagement in long-term BCI clinical trials*

Presenters

- **Ashley Feinsinger,** *University of California, Los Angeles*
- **Jen Collinger,** *University of Pittsburgh*
- **Jennifer French,** *Neurotech Network*
- **Sonja Kleih-Dahms,** *University of Würzburg*
- **Heather Dean,** *US Food and Drug Administration*

While ethicists, researchers, and study participants have expressed the importance of lived experience engagement in Brain-Computer Interface (BCI) studies, there is neither consensus nor widespread guidance on what engagement in these studies would encompass, why it should be done, and how to do it. Community engagement is limited to mechanisms of consultation with people with lived experience prior to designing a study, during study recruitment, and results dissemination. While important, this ignores the significant expertise of individuals who are participating in long term BCI clinical trials that often require years of intensive involvement, sometimes including surgery to implant the device, with no promise of direct clinical benefit. Companies are seeking to bring BCIs to market so now is a crucial time to advance guidance on participant engagement to maximize the benefits of technology for current and future participants. However, we recognize that participant engagement comes with challenges and uncertainties about how to do it effectively. The workshop will describe the current state of community and participant engagement, gaps in current practices and underappreciated opportunities for improved participant engagement, and the ethical foundations that should guide increased engagement efforts. Breakout groups will inform the development of guidance for participant engagement.

Wednesday, June 4

9:45am - 12:45pm

SESSION 2

W9: *Clinical translations of BCI: From lab to daily life*

Presenters

- **Anouck Schippers,** *UMC Utrecht Brain Center*
- **Nicholas Card,** *University of California, Davis*
- **Theresa Vaughan,** *Samuel Stratton VA Medical Center*

For BCIs to reach their full potential for end-users, the technology must be functional outside of controlled laboratory settings, inside the homes of the end-users. At-home BCI use can provide valuable insights that can be used for the development of robust decoding algorithms that enable reliable BCI performance regardless of the environment where the BCI is used. Clinical translation of BCIs from lab to daily life can provide also highlight additional functionalities desired by the end-user and their caregivers that, when implemented, can boost technology adoption. However, at-home research or independent, unsupervised home use of BCIs are not yet standard practice. This workshop aims to promote the clinical translation of BCIs towards home use by sharing the experiences of various research groups, and by discussing the potential hurdles that face at-home BCI use.

W10: *Designing speech BCIs that facilitate good communication for users*

Presenters

- **B.J. (Bouke) van Balen,** *UMC Utrecht Brain Center*
- **Eran Klein,** *Oregon Health and Sciences University (OHSU)*
- **Betts Peters,** *Oregon Health and Sciences University (OHSU)*
- **David Moses,** *University of California, San Francisco*

Implantable speech BCIs bear the promise of 'restoring naturalistic communication' for users who have lost this capacity due to severe paralysis (Metzger et al., 2023). The promise of restoration to naturalistic communication raises the question: what does it mean to communicate naturally, and is this the same as what people with severe paralysis desire in their communication? Ethicists have been raising the concern that designers of AAC devices often work with the narrow assumption that restoring communication equates to translation of semantic information into discrete action, such as signaling basic needs or ringing an alarm, thereby missing out on other more subtle and embodied types of communication such as nodding, facial expressions, cadence, tone, and intonation (Van Balen 2024;Van Grunsven, Van Balen & Bollen, 2024). This workshop will center around a philosophical and a practical question: "What does it mean for users of implantable speech-BCIs to communicate well and which lessons for future design can we learn from this?"We approach these questions from an interdisciplinary angle, with contributions from experts in the fields of ethics, user-perspectives, AAC-design, and neuroscience (part 1). In part 2 we will do a critical design exercise with participants in groups, whereafter we will list concrete design recommendations in a plenary discussion.

W11: *Toward theories of Brain-Computer Interaction*

Presenters

- **Fabien Lotte,** *Institut National de Recherche en Informatique et en Automatique*
- **Jonathan Wolpaw,** *Stratton VA Medical Center*
- **Amy Orsborn,** *University of Washington*
- **Sonja Kleih-Dahms,** *University of Würzburg*

Despite sustained progress and intensive research efforts, BCI are still scarcely used outside laboratories, notably due to their relatively low reliability & usability and large inter-user and intra-user variabilities. To address these issues, most BCI research is based on trial-and-error, e.g., exploring classification or training approaches in the quest for the most effective ones, without underlying theory that could explain or predict why some methods work and some others do not. This is bound to lead to suboptimal BCI design and/or slow scientific progress. Most studies are addressing problems without the guidance that coherent theories of BCI structure and function could provide. There is thus a strong need for theories in BCI research. We focus here on theories as defined, e.g., by the American Psychology Association: "a principle or body of interrelated principles that purports to explain or predict a number of interrelated phenomena."

W12: *Legal perspectives on BCIs: Navigating challenges from malfunctions to gdpr compliance and discrimination*

Presenters

- **Harry Lambert,** *The Centre for Neurotechnology and Law*
- **Allanah Beazley,** *Blackrock Neurotech*
- **Reinhold Scherer,** *University of Essex*

Brain-Computer Interfaces (BCIs) offer real-time insights into mental states, enhancing human-machine interaction, particularly for those with neurological conditions and disorders. While research emphasizes neuroscientific and technological advancements, ethical considerations, and commercialization standards, the legal implications remain underexplored. This workshop addresses critical legal questions arising in BCI research, clinical applications, and commercialization. Participants will learn when BCIs qualify as medical devices under the European Medical Device Regulation, understand the legal consequences of BCI malfunctions and data breaches, and examine issues related to GDPR compliance and discrimination. Additionally, we will explore how BCI-derived insights into human behavior can influence legal accountability and potentially lead to new legal frameworks. Through interactive activities, attendees will gain the legal expertise necessary to navigate litigation involving BCIs, fostering the development of more sophisticated and legally compliant technologies.

W13: *Stronger together: Harnessing the power of patient-partner engagement in BCI*

Presenters

- **Dejana Nikitovic,** *University of Alberta & University of Calgary*
- **John Andersen,** *University of Alberta*
- **Alicia Hilderley,** *University of Calgary*
- **Dion Kelly,** *University College London*

The Stronger Together: Harnessing the Power of Patient Partner Engagement in BCI workshop will focus on priority setting for patient partner engagement in Brain-Computer Interface (BCI) research. Building on the BCI community's extensive experience of working closely with BCI users, the workshop will explore different levels of patient engagement, from patient-oriented design to patient-led research. The workshop objectives are: 1) discuss patient partner engagement in the BCI context, 2) share research, clinical and industry examples of patient partner engagement in BCI projects, and 3) work together to identify what is necessary to build strong, impactful, effective partner engagement programs within the complex transdisciplinary field of BCI. Workshop participants will brainstorm the benefits, opportunities, and challenges of partner engagement initiatives as part of small groups that will include researchers, BCI users and their families/caregivers with lived experience. The workshop will serve as a first step in developing communityinformed recommendations for patient partner engagement in BCI research. Following the workshop, attendees will be invited to participate in a Delphi process to finalize recommendations to be shared broadly.

W14: *Brain-Computer Interface clinical trial design considerations and clinical outcomes assessments in pivotal studies*

Presenters

- **Leigh Hochberg,** *iBCI-CC, Mass General Hospital*
- **Abbey Sawyer,** *Mount Sinai Health System*
- **Matt Angle,** *Paradromics*
- **Rob Franklin,** *Blackrock Neurotech*
- **Jackie Dister,** *Precision Neuroscience*
- **Tom Oxley,** *Synchron*
- **Dustin Herrmann,** *Neuralink*
- **Scott Stanslaski,** *Medtronic*

Early feasibility studies (EFS) of implantable Brain-Computer Interfaces (iBCIs) have demonstrated promising initial safety and efficacy results for recovering communication and sensorimotor functions in patients with paralysis from amyotrophic lateral sclerosis (ALS) and spinal cord injury (SCI). International pivotal trials to demonstrate clinical effectiveness and the definitive benefits to patients are expected in the next 5 years. To navigate the critical evidence to be collected in the pivotal trials, industry and academics in the BCI field need guidance about clinical trial considerations specific to this stage and type of research. Towards this end, an initial public workshop jointly organized by the FDA/NIH was held in 2024 focused on developing iBCI Clinical Outcome Assessments (COAs). The objective of this BCI Society conference workshop is to present current thinking on BCI clinical trial considerations, with a focus toward clinical trial design and outcome assessments, and seek further input from stakeholders in the BCI society. Given this is an international meeting, FDA/NIH will be joined by other national regulators such as MHRA, UK. The outcome of this workshop will be an initial consensus of clinical trial considerations and CoA measures to be used in BCI pivotal trials.

W15: *Building a 5-year roadmap for implantable BCIs for pediatrics and pediatric onset-conditions*

Presenters

- **Adam Kirton,** *University of Calgary*
- **Mariska Vansteensel,** *UMC Utrecht Brain Center*
- **Alistair Mcewan**
- **Eli Kinney-Lang,** *University of Calgary*

Implantable BCI systems are maturing rapidly. For those with pediatric onset conditions affecting motor and speech function, such as cerebral palsy, implantable BCIs are a revolutionary technology that could greatly enhance their independence and support them in activities of daily living, leading to potential life-long use. However, implantable BCIs for this population have not yet been possible due to many complex barriers. This workshop aims to collaboratively build a 5-year roadmap for tackling these barriers, to encourage the inclusion of this large global population in the rapidly developing implantable BCI space. The workshop will include a review of the past 18 months of collaborative work that followed the 1st International Summit on Implantable BCIs for Children withComplex Needs in early 2024, as a starting place for small-group development and discussion. It will include sessions on several themes relevant to advancing implantable BCIs for children and adults with pediatric onset conditions and complex needs. These themes include:

1. Brain structure and function in pediatric onset conditions
2. Functionalities of implantable BCIs and their current barriers
3. Advantages and disadvantages learned from other implanted technologies
4. User-centered designs for implantable BCIs across the lifespan

Thursday, June 5

9:45am - 12:45pm

SESSION 3

W17: *Invasive Brain-Computer Interfaces using neuromodulation for clinical applications*

Presenters

- **Peter Brunner,** *Washington University School of Medicine in St. Louis*
- **Johannes Grünwald,** *g.tec medical engineering GmbH*
- **Kai Miller,** *Mayo Clinic*
- **Martin Schuettler,** *CorTec GmbH*

Neuromodulation systems use Brain-Computer Interface operating principles to deliver targeted neurostimulation directly to the nervous system, and to realize therapies for neurological and psychiatric conditions such as epilepsy, depression, and movement disorders. Progress in the research and development of neuromodulation therapies depends on a cadre of investigators who understand clinical needs, can identify relevant research questions, and can translate their research interests into effective interdisciplinary research programs. This workshop aims to provide participants with a comprehensive overview of open-loop and closed-loop neurostimulation approaches, as well as insight into research methodology, technical design, and clinical applications. Designed for neurophysiologists, clinicians, engineers, and researchers, this workshop offers an interdisciplinary examination of invasive neuromodulation-based BCI technology. It features presentations by experts at the forefront of their respective fields, covering topics ranging from advanced methodologies in data interpretation, system design and implementation, and clinical applications of neuromodulation. Through interactive presentations, this workshop will engage participants who will break out into group discussions to discuss challenges and opportunities that will shape the future of neuromodulation-based BCIs in clinical practice.

W18: *Building Consensus on implant targeting strategies for intracortical sensorimotor Brain-Computer Interfaces*

Presenters

- **Hunter Schone,** *University of Pittsburgh*
- **David Bjånes,** *Institute of Technology*
- **Mathew Glasser,** *Washington University*
- **Frank Willet,** *Stanford University*
- **Dan Adams,** *Neuralink*
- **Sanne Kikkert**
- **Stephen Foldes,** *Barrow Neurological Institute, Phoenix Children's Hospital*
- **David McMullen,** *Food and Drug Administration (FDA)*
- **David Brandman,** *University of California, Davis*
- **Nick Ramsey,** *University Medical Center Utrecht*

Are you planning on implanting a human participant with an intracortical BCI? BCI functionality is largely constrained by the neural tuning of the neurons your implanted electrodes interface with; thus, precise targeting of the desired implant site is essential for maximizing research and therapeutic outcomes. Given the diversity in cortical surface geometry across individuals, neuroanatomical markers alone may not be sufficient to target the same functional area across participants. Over the last decade, a variety of targeting strategies have emerged to identify optimal implant sites including: non-invasive neuroimaging (fMRI, MEG) to awake intraoperative neural recordings and stimulation. To date, academic and industry groups have worked independently with limited discourse on the success of attempted approaches. In this workshop, we invite all intracortical BCI stakeholders to engage with our panel of experts in neuroimaging, neurosurgery and neural engineering to openly discuss existing targeting strategies. The workshop will be structured based on function, starting with motor control (of speech and hand/arm) and then sensory BCIs, concluding with a clinical perspective on participant needs and surgical considerations. Throughout each section, we will facilitate discussion where attendees can ask questions, discuss pitfalls and expertise required for each methodology. Ultimately, this workshop aims to propel the field towards greater consensus on successful implant targeting strategies for BCIs.

W19: *Exploring features to improve BCI: Challenges and opportunities*

Presenters

- **Serafeim Perdikis,** *University of Essex*
- **Tristan Venot,** *Institut National de Recherche en Informatique et en Automatique*
- **Marie-Constance Corsi,** *Institut National de Recherche en Informatique et en Automatique*
- **Maryam Alimardani,** *Vrije Universiteit Amsterdam*
- **Pierpaolo Sorrentino,** *INSERM*
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- **Sonja Kleih-Dahms,** *University of Würzburg*
- **Tomko Settgast,** *University of Wuerzburg*
- **Reinhold Scherer,** *University of Essex*
- **José del R. Millan,** *University of Texas at Austin*
- **Arthur Desbois,** *Institut National de Recherche en Informatique et en Automatique*

BCIs constitute a promising tool for treating or circumventing neurological symptoms and promoting neurorehabilitation strategies. Yet, they fail to detect mental intentions in about 30% of the users. Multiple ways to tackle this issue have been proposed, mainly by either establishing a machine capable of sensing subtle variations in the data that are consistent enough for a precise controller or by finding consistent behavior and patterns of training. In this workshop, we propose to bridge the gap between these aspects by focusing on the identification, the selection, and the assessment of the information used to translate the brain activity into commands, namely, the features.

The workshop will be split into three parts. In the first part, an overview of existing and emerging features will be presented. The second part will be dedicated to the clinical relevance of novel features. The third part will focus on guidelines and concrete recommendations when dealing with the BCI features' instability. Finally, to structure the general discussion in direct alignment with the challenges faced by the community, the discussion will be guided by a selection of pre-arranged questions asked by the participants head on.

W20: *Towards restoring speech and non-verbal communication with Brain-Computer Interfaces*

Presenters

- **Jaimie Henderson,** *Stanford University*
- **Marc Slutzky,** *Northwestern University*
- **Kaylo Littlejohn,** *University of California, San Francisco*
- **Maitreyee Wairagkar,** *University of California, Davis*

During the last BCI Society meeting in 2023, we hosted a workshop titled "Understanding and utilizing the neural basis of speech: from basic science to neuroprostheses". The workshop attracted significant interest from the meeting attendees and highlighted advances in Brain-Computer Interfaces for communication in individuals who have lost the ability to speak. Novel research directions have emerged since then, including decoding of individual voice characteristics from brain activity, use of minimally invasive stereo-EEG recordings and decoding facial movements for verbal and non-verbal communication. These studies contribute to our understanding of speech representation in the brain, and demonstrate the potential of transferring this knowledge to applications in end users. However, many challenges remain on the path to clinical application. Key questions persist around the ethical use of artificial intelligence and large language models, the practicalities of real-world deployment, and the effectiveness of brain-to-text, brain-to-voice, and brain-to-face decoding approaches. This year's workshop will provide an update on the latest advancements in the field and host a panel discussion on scientific progress and clinical translation.

W21: *Large neural data models for Brain-Computer Interfaces*

Presenters

- **Joel Ye,** *Carnegie Mellon University*
- **Matthew Perich,** *Université de Montréal*
- **Motoshige Sato,** *Araya Inc.*
- **Alisa Levin,** *Stanford University*
- **Geeling Chau,** *University of California, San Diego*
- **Matthias Dold,** *Radboud University*
- **Madison Kelberman,** *University of Michigan*
- **Ann-Kathrin Kiessner,** *University of Freiburg*
- **Icare Sakr,** *École Polytechnique Fédérale de Lausanne*

Modern deep learning research has demonstrated that large deep networks trained on large datasets can provide a strong base model that enables rapid, high performance modeling in subsequent settings. This initial phase is termed pretraining, and when performed at sufficiently large scale, these models are termed foundation models. The effectiveness of foundation models has enabled a qualitatively different route to progress in disciplines such as natural language processing and computer vision, centered primarily around the study of how to best create strong base models that can be efficiently adapted to many downstream use cases. Scaling pretraining for Brain-Computer Interfaces raises a number of challenges that are currently studied independently across neural data domains. For example, each new proposed model will include discussion of modality-specific data processing, preparation over large volumes of heterogeneous data, and evaluation challenges dependent on the downstream use cases. Establishing best practices for these choices is particularly important given the high expense and complexity of preparing these foundation models.

W22: *Stimulate the senses to increase performance: The importance of afference in restorative Brain-Computer Interfacing*

Presenters

- **Ceci Verbaarschot,** *University of Pittsburgh*
- **Alexander Remsik,** *University of Wisconsin, Madison*
- **Isabelle Rosenthal,** *Feinstein Institutes for Medical Research*
- **Roberto M. De Freitas,** *University of Pittsburgh*
- **Annike Bekius,** *University Medical Center Utrecht*
- **Matija Milosevic,** *University of Miami*
- **Ashley Feinsinger,** *University of California, Los Angeles*

In this workshop, we focus on improving the sensory and motor capabilities of a person's upper limbs using Brain-Computer Interfacing (BCI). Although the idea of restorative BCIs is not new, the applied methodologies have changed significantly over the past few years; from primarily non-invasive open-loop BCI to invasive closed-loop BCI with or without synchronous spinal cord stimulation. The latter has demonstrated incredible functional improvements in motor control even years after, e.g., a spinal cord injury. As these exciting developments progress, we wonder (1) what role sensory feedback plays in the restoration of lost function and improvement of quality of life, (2) how artificially-evoked sensations may provide an effective substitute during rehabilitation, and (3) how we can best fit our research goals to benefit our target user. A team of scientists, ethicists and people living with sensory and motor deficits will provide their perspective on achieved and desired success in restorative BCI. We will discuss alternative forms of sensory feedback across various levels of intervention; from non-invasive neuroimaging techniques to invasive brain recordings coupled with spinal cord stimulation. Together, we aim to spotlight the role of sensory feedback in neuro-rehabilitation and define measurable research goals that clearly serve our target user.

W23: *Reaching consensus on BCI scientific reporting*

Presenters

- **Ricardo Chavarriaga,** *Zurich University of Applied Sciences*
- **Katharine "Katya" Hill,** *University of Pittsburgh*
- **Luigi Bianchi,** *Tor Vergata University*
- **Mariska Vansteensel,** *UMC Utrecht Brain Center*

Since the 2023 standardization workshop, the BCI Society has emphasized the need for a clear definition of BCI/BMI to ensure a shared understanding. Concurrently, the IEEE SA WG P2794 has developed a reporting checklist to improve reporting of BCI research. To finalize and validate this checklist, we plan to host a workshop to develop consensus around the proposed standard using a modified Delphi method (1). Before the workshop, subject matter experts will review the draft checklist, and the checklist will be made available in advance to all workshop participants. During the workshop, at least 20 workshop members will participate in anonymous, iterative survey rounds via smartphones to refine the checklist. Moderated feedback will follow each round, with discussions to address any concerns. An online consensus meeting will take place two weeks after the workshop, and the final checklist will be submitted for publication.

Reporting checklists have been widely adopted in medical and assistive technology research (2) to improve the quality and interpretability of study reporting. Introducing an observational and interventional reporting checklist for BCI research is expected to improve reporting quality, increase citation counts (3), and enhance the likelihood of translating research findings into practical applications.

W24: *Engaging communities that produce commercial reports and analyses about BCIs*

Presenters

- **Brendan Allison,** *University of California, San Diego*
- **Patrick Britz,** *NIRx Medizintechnik GmbH*
- **Conor Russomanno,** *OpenBCI, Inc.*
- **Jonathan Wolpaw,** *Stratton VA Medical Center*
- **Christoph Guger,** *g.tec medical engineering GmbH*
- **Ramses Alcaide**
- **Jörn Rickert**

The last decade has seen the rise of "Big BCI" programs from huge entities including Facebook, Neuralink, and Galvani Bioelectrics. Concordantly, large companies such as Morgan Stanley and Gartner and other entities like Neurotech Reports have recently produced reports that analyze challenges, opportunities, companies, and stakeholders involving BCIs. As BCIs continue to grow, business and tech reports about BCIs will become more prominent. These commercial reports and analyses could benefit from engagement with people who use or work with BCIs. This reflects a common concern within the BCI community: stakeholder fragmentation. Experienced BCI researchers, companies, and users could improve the completeness, quality, and trustworthiness of these reports. Increased interaction could also help companies that produce neurotechnologies engage large-scale investors and provide more helpful information to readers.

Travel Awards

The following are the recipients of the 2025 BCI Meeting Student Award. The award is sponsored by the National Institutes of Health NIDCD, NINDS, the National Science Foundation with support from Connected Minds, the Tianqiao & Chrissy Chen Institute, and Blackrock Neurotech.

Artur Agaronyan, *The Catholic University of America*
Annike Bekius, *University Medical Center Utrecht*
Rashi Bhatt, *Emory University, Georgia Institute of Technology*
David Bjånes, *California Institute of Technology*
Anna Bourgeois, *University of Calgary*
Edgar Canario, *University of Pittsburgh*
Daniel Candrea, *Johns Hopkins University*
Valentina Caracci, *Sapienza University of Rome*
Nicholas Card, *University of California, Davis*
Basak Celik, *Northeastern University*
Geeling Chau, *California Institute of Technology*
Nikole Chetty, *Carnegie Mellon University*
Chiara Ciucci, *Scuola Superiore Sant'Anna*
Jonathan Coutinho, *Queen's University*
Anarghya Das, *University at Buffalo*
Michael Dexheimer, *Virginia Commonwealth University*
Keqin Ding, *Johns Hopkins University*
Claire Dussard, *Sorbonne Université*
Teng Fei, *University of California San Diego*
Crispin Foli Case, *Western Reserve University*
Richard Gall, *University of Pittsburgh*
Catalina Galván, *Instituto de Matemática Aplicada del Litoral*
Jules Gomel, *Université de Toulouse*
Mona Hejazi, *Memorial University of Newfoundland*
Jordan Hickman, *University of Colorado Anschutz Medical Campus*
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Sara Houshmand, *University of Alberta*
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Mark Iskarous, *University of Chicago*
Xilin Jiang, *Columbia University*
Justin Jude Brain, *Gate – Massachusetts General Hospital*
Tianhao Lei, *Northwestern University*
Tengjun Liu, *Zhejiang University*
Deland Liu, *University of Texas Austin*
Ximing Mai, *Shanghai Jiaotong University*
Valerie Marissens Cueva Inria, *Université de Bordeaux/LABRI and LORIA, Université de Lorraine*
Mary Mcintosh, *Dalhousie Medical School*
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Maarten Ottenhoff, *Brown University*
Jimmy Petit, *Harvard Medical School | Massachusetts Eye and Ear*
Jacob Prince, *Harvard University*
Erin Radcliffe, *University of Colorado Anschutz Medical Campus*
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Blackrock Neurotech is a team of the world's leading engineers, neuroscientists, and visionaries. Our mission is simple: We want people with neurological disorders to walk, talk, see, hear, and feel again. We're engineering the next generation of neural implants, including implantable brain-computer interface technology that restores function and independence to individuals with neurological disorders. Join us in changing lives today.

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Connected Minds is a bold, interdisciplinary research initiative led by York University in partnership with Queen's University that explores how new technologies are transforming society. Through community-engaged, socially responsible research, the program investigates the complex relationship between neural and machine systems to help build a healthier, more just society. Our goals are to understand the emerging properties of human-technology interactions, predict the social impacts of technologies such as artificial intelligence, robotics, and brain-computer interfaces, and inform the design of policies, technologies, and regulations that benefit all members of society. With a strong commitment to co-creation, equity, and real-world impact, Connected Minds is shaping Canada's future as a leader in ethical and inclusive technological innovation.

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The Science Partner Journal Cyborg and Bionic Systems is an online-only Open Access journal published in affiliation with Beijing Institute of Technology (BIT) and distributed by the American Association for the Advancement of Science (AAAS). The journal publishes original, peer-reviewed articles based on fundamental, applied science, or their interaction. It also covers a wide range of fields related to cybernetic organisms (cyborg) and bionic systems (CBS), mainly including robotics, biomedical engineering and neuro-engineering.

G.TEC MEDICAL ENGINEERING

www.gtec.at

g.tec medical engineering was founded in 1999 by Dr. Christoph Guger and Dr. Günter Edlinger in Austria. The company specializes in developing high-performance brain-computer interfaces and neurotechnologies for both invasive and non-invasive recordings in research and clinical settings.

g.tec's product portfolio includes biosignal amplifiers, EEG electrodes and caps, and stimulation devices used for brain monitoring and rehabilitation. g.tec is renowned for its commitment to innovation and quality in the medical engineering field, making significant contributions to advancements in neurotechnology.

IBCI-CC

www.ibci-cc.org

The goal of the Implantable Brain-Computer Interface Collaborative Community (iBCI-CC) is to foster collaboration among diverse stakeholders, including researchers, clinicians, medical device manufacturers, patient advocacy groups, and people with lived experience, to accelerate development, safety and efficacy evaluation, and access to implantable BCI technologies.

KAPTICS

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Kaptics is your ideal partner for research projects combining BCI and virtual reality. We are especially known for our expertise in collecting physiological signals (EEG, EOG, ECG, etc.) in immersive environments.

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Neuracle Neuroscience provides mobile-battery operated EEG, EMG, and tES systems that will perfectly balance cost and capabilities. Systems are designed to provide optimized data streaming and trigger integration, allowing maximum flexibility to expand labs and meet today's demanding multimodal and neuromodulation research.

NEUROXESS

en.neuroxess.com

NeuroXess, a leading Chinese Brain-Computer Interface (BCI) company, specializes in flexible electrode technology to decode brain signals, facilitating applications like motor and speech restoration. Driven by a mission to advance human cognition and foster AI collaboration, NeuroXess is dedicated to groundbreaking neurological solutions and building international partnerships for future innovation.

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NIRx Medizintechnik GmbH is a leading provider of comprehensive solutions for functional near-infrared spectroscopy (fNIRS) research. Our non-invasive and user-friendly fNIRS technology enables the measurement of neural activity in the cortex and large-scale cortical networks, providing insights into the neural mechanisms underlying perception and cognition.

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Paradromics is building the highest data-rate brain-computer interface (BCI) platform. Its advanced neurotechnology captures brain activity at the highest resolution, the individual neuron. This rich brain data lays the foundation for boundless AI-enabled treatments for motor impairment, chronic pain, addiction, depression, and other mental health conditions. Paradromics' first clinical product, Connexus® BCI, is designed to help people unable to speak due to debilitating motor conditions communicate independently through digital devices.

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Precision Neuroscience is working to provide breakthrough treatments for the millions of people worldwide suffering from neurological illnesses. The company is building the only brain–computer interface designed to be minimally invasive, safely removable, and capable of processing large amounts of data. To learn more about how Precision is connecting human intelligence and artificial intelligence, visit precisionneuro.io.

SCIENCE ROBOTICS

www.science.org/journal/scirobotics

Science Robotics is a multidisciplinary research journal covering traditional disciplines of robotics as well as emerging technologies closely related to robotics.

SYNCHRON

synchron.com

Synchron, a brain interface platform company, is a leader in the field of implantable neural interface technology. The clinical-stage company is developing a neuroprosthesis for the treatment of paralysis and the first endovascular implantable neuromodulation therapy. Future applications may include the potential to diagnose and treat conditions of the nervous system, including Parkinson's disease, epilepsy, depression, and hypertension. Headquartered in New York City, Synchron has offices in Silicon Valley, California and R&D facilities in Melbourne, Australia.

TIANQIAO & CHRISSY CHEN INSTITUTE

www.cheninstitute.org

The Tianqiao and Chrissy Chen Institute (TCCI®) was created in 2016 by Tianqiao Chen and his wife Chrissy Luo, the founders of Shanda Group, with a US $1 billion commitment to help advance fundamental brain research around the world. TCCI® created TCCI for Neuroscience at Caltech in 2016. In 2017, the couple created the Tianqiao Chen Institute for Translational Research, a partnership with the Zhou Liangfu Foundation, Huashan Hospital and Shanghai Mental Health Ctr. In October 2020, TCCI opened the Chen Frontier Lab for Applied Neurotechnology and the Chen Frontier Lab for AI and Mental Health opened in July 2021.

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ZANDER LABS

www.zanderlabs.com

Zander Labs is a German-Dutch deeptech company, is at the forefront of passive Brain-Computer Interface (pBCI) and neuroadaptive technology. We are developing a user-friendly platform that uses pBCI technology to seamlessly integrate human cognition with computers and artificial intelligence. Our mission is to transform human-computer interaction (HCI) and cognitive Artificial Intelligence by driving a moonshot initiative. Our vision is to create a world where technology understands and learns from us and understands the world around us. This synergy between humans and machines is at the heart of our innovations to improve AI capabilities, increase productivity and enhance effectiveness.

Research Session 1

Tuesday, June 3

2:00pm - 3:30pm

RS-1-1 *Navigating the clinical trial pathway for implantable brain-computer interfaces: The COMMAND study*

Thomas Oxley[1], Shahram Majidi[2], Raul Nogueira[3], Elad Levy[4], David Lacomis[5], Amit Kandel[6], Noam Harel[2], David Putrino[2], Douglas Weber[7]

[1] Synchron, [2] Icahn School of Medicine at Mount Sinai, [3] University of Pittsburgh Medical Center, [4] State University of New York at Buffalo, [5] University of Pittsburgh, [6] University of Buffalo, [7] Carnegie Mellon University

Introduction: Implantable brain-computer interfaces (BCIs) can enable people with paralysis to control digital devices using decoded brain signals. Predominantly, implantable BCIs have required craniotomy to place penetrating or surface electrodes on the brain, with some of these systems depending on transcutaneous ports for connectivity, leaving components visible and outside of the body. The Synchron BCI is a fully implanted system delivered using a minimally invasive endovascular technique. Following a first-in-human study completed in Australia (SWITCH trial1; n=4 participants), we present the results of the COMMAND early feasibility study — the first FDA-approved trial of a permanently implanted BCI — along with key insights gained from the clinical trial pathway.

Material, Methods, and Results: The COMMAND study (ClinicalTrials.gov registration: NCT05035823) was a prospective, multi-center, single-arm, open label, early feasibility study (EFS) conducted under an investigational device exemption (G210178). The COMMAND EFS evaluated the safety and feasibility of the Synchron BCI in six participants with chronic severe bilateral upper limb paralysis. The primary endpoint was device related serious adverse events resulting in death or permanent increased disability. Secondary endpoints were device migration and target vessel patency. Additional outcomes explored BCI decoding of neural signals to generate 'digital motor outputs' for digital device control.

All six participants were successfully implanted with the endovascular BCI. Each participant met the primary study endpoint with no device related adverse events resulting in death or permanent increased disability during the one-year post-implant evaluation period. Additionally, there was preserved target vessel patency and no evidence of device migration at 3- and 12-months post-implant. Four out of six participants demonstrated consistent BCI decoding performance, enabling them to successfully perform various digital device control tasks throughout the one-year post-implant evaluation period. Of the remaining two participants: one experienced rapid progression of ALS leading to the withdrawal of life-sustaining care and the other encountered system signal artifacts, both of which impacted their ability to effectively use the BCI.

Conclusion: Endovascular access to brain regions for the placement of BCI sensors is an alternative to procedures requiring open-brain surgery. In addition to the favorable safety profile of endovascular procedures, the prevalence of angiography suites and neurointerventionalists capable of performing these procedures could promote wider and more rapid translation of BCI for people with paralysis. Results from the COMMAND EFS demonstrate early indication of safety and effectiveness of Synchron's endovascular BCI for participants with severe bilateral upper limb paralysis. Results and learnings from this study will contribute to the clinical translation of implantable BCIs via the clinical trial pathway.

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RS-1-2 *The first BCI clinical trial for stroke neurorehabilitation in Latin America: The ReHand-BCI trial*

Jessica Cantillo-Negrete [1], Martin Emiliano Rodriguez-Garcia [2], Paul Carrillo-Mora [1], Oscar Arias-Carrion [3], Emmanuel Ortega-Robles [3], Marlene Galicia-Alvarado [1], Raquel Valdes-Cristerna [2], Ana Guadalupe Ramirez-Nava [1], Claudia Hernandez-Arenas [1], Jimena Quinzaños-Fresnedo [1], Ma Del Refugio Pacheco-Gallegos [1], Norma Marin-Arriaga [1], Ruben Carino-Escobar [1]

1 Instituto Nacional de Rehabilitacion, [2] Universidad Autónoma Metropolitana, [3] General Hospital Manuel Gea Gonzalez

RS-1-3 *Integrating BCI, FES, and social media for Rehabilitation of Upper Extremity Motor Function in Youth*

Anna Bourgeois [1], Meghan Maiani [1], Araz Minhas [1], Brian Irvine [1], Ion Robu [2], Payton Shaw [1], Dejana Nikitovic [3], Zeanna Jadavji [1], Gregory Wilding [2], Nathan Brand [2], Mateo Ambrogiano [2], Emily Schrag [1], Nicole Romanow [1], Adam Kirton [1], Eli Kinney-Lang [1]

[1] University of Calgary, [2] Alberta Children's Hospital, [3] University of Alberta & University of Calgary

Introduction: Perinatal stroke can lead to lifelong physical disabilities, but even small improvements in function can significantly increase quality of life. There is a window of opportunity after perinatal stroke to harness brain plasticity to improve outcomes.1 However, current therapies are minimally effective, in part due to the boring, unengaging procedures required to achieve adequate repetitions that are not suited to children.1 The combination of functional electrical stimulation and brain computer interface (FES/BCI) has been shown to be effective for adults with stroke2 and hemiparesis and appears feasible in children.3 We designed a novel FES/BCI system that uses social media to better engage youth, called "FlickTok".

Methods and Results: The research protocol was informed through engagement with three youth patient partners with lived experience who developed and tested FlickTok. Each participant is fitted with a 16 channel EEG gel headset. The BCI training consists of 20 trials of attempted movement and rest which is then classified using a binary Riemannian Geometry based motor imagery classifier. After training is complete, participants can independently swipe through videos that are coordinated with FES. Data collected includes Cohen's Kappa and motor assessments of passive and active range of motion and the box and blocks (BB) test. Participants complete qualitative interviews to obtain enjoyability metrics to further improve the system. To date, 7 participants have completed at least one session. Early results indicate technical feasibility and increased enjoyability. Initial qualitative interviews have explored functional improvements and methodological changes that should be implemented in future studies. The BB assessment improved by 29% and 45% respectively after 3 sessions of FlickTok in 2 participants.

Conclusion: Informed by users, simple EEG-based BCI can be integrated with FES and social media to perform upper extremity rehabilitation in youth with hemiparesis. This pilot trial will inform the design of future clinical trials required to evaluate efficacy.

RS-1-4 *From ECoG signals to cervical epidural electrical stimulation: Restoring arm and hand movements after a spinal cord injury*

Thibault Collin [1], Ina Bianca Yu [1], Icare Sakr [2], Valeria Spagnolo [3], Sergio Daniel Hernandez Charpak [1], Nadine Intering [1], Julie Hervé [1], Céline Deschenaux [1], Gaia Carparelli [1], Felix Martel [4], Rémi Souriau [4], Alice Bruel [1], Pedro Abranches [1], Nicolas Hankov [1], Grégory Dumont [1], Pierre Bessot [5], Charlotte Jacquet [5], Anne Watrin [1], Léa Bole-Feysot [1], Charles David Sasportes [1], Malo Simondin [1], Cathal Harte [1], Serpil Karakas [4], Laure Coquoz [1], Vincent Rouanne [1], Federico Ciotti [1], Simon Dahan [1], Frédéric Merlos [1], Philippe Forrero [1], Rémy Tang [1], Andrea Galvez [1], Jean-Baptiste Ledoux [6], Camille Haxaire [1], Carole Poulin [1], Fabio Becce [6], Stefano Carda [6], Viviana Aureli [1], Matthieu Bosquet [7], Marina D'ercole [5], Julien Dedelley [5], Leonie Asboth [1], Robin Demesmeaker [1], Fabien Sauter [7], Olivier Faivre [4], Tetiana Aksenova [8], Guillaume Charvet [7], Jocelyne Bloch [9], Gregoire Courtine [9], Henri Lorach [2]

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A cervical spinal cord injury (SCI) disrupts the communication between the brain and the spinal cord, causing lasting impairments in arm and hand functions. Epidural Electrical Stimulation (EES) has been shown to enhance motor activity by stimulating large-diameter afferent fibers. Integrating EES with brain inputs through an artificial bridge offers the potential to further enhance recovery.

In this study, we developed a novel framework to restore voluntary control of arm and hand movements by creating an artificial bridge across the lesion. Participants with incomplete cervical SCIs were implanted with an electrocorticographic device over the sensory-motor cortex (WIMAGINE ECoG) and spinal cord arrays spanning across cervical levels, connected to pulse generators (ONWARD IPGs). We optimized electromyographic activity and induced kinematics using tailored stimulation parameters, developing a heuristic myotome to identify frequency preferences for motor neuron activation. We designed ECoG-based strategies and algorithms to decode participants' motor intentions, enabling state-specific modulation of EES parameters during two months of rehabilitation.

Our findings demonstrate the safety and feasibility of this system and highlight its potential to advance rehabilitation strategies for restoring voluntary motor function in individuals with cervical SCIs.

RS-1-5 *Adaptive Closed-Loop Neurofeedback Brain-Computer Interface for Treatment of Laryngeal Dystonia*

Jimmy Petit [1], Stefan Ehrlich [1], Garrett Tougas [2], Jacob Bernstein [2], Nicole Buie [2], Kristina Simonyan [1]

[1] Harvard Medical School, [2] Mass Eye and Ear

Introduction: Laryngeal dystonia (LD) is a task-specific focal dystonia characterized by involuntary spasms of laryngeal muscles that selectively impair the production of speech but not whispering, crying, or laughing. A recent EEG study [1] showed apparent differences in brain activity between speaking and whispering in LD patients compared to healthy individuals. In a double-blind, sham-controlled study, we aimed to build on the selectivity of speech impairment in LD for the development of a non-invasive adaptive closed-loop neurofeedback-based brain-computer interface (NF-BCI) for the treatment of this disorder.

Material, Methods, and Results: Eighteen LD patients participated in the study, divided into two groups: nine in the active condition and nine in the sham condition. The personalized EEG-based NF was displayed using the head-mounted virtual reality (VR) goggles and included real-life scenarios with various auditory and visual complexity and high vocal demand to elicit LD symptoms. Over five consecutive days, each patient participated in two one-hour NF-BCI sessions daily, during which they were trained to modulate abnormally increased EEG activity associated with impaired speaking to the levels associated with normal whispering. All patients assessed changes in their symptom severity after each session using a Likert-item questionnaire, ranging from -5, Worsened to +5, Improved. In addition, patients assessed their level of comfort, engagement, concentration, controllability, and responsiveness during NF-BCI sessions. Repeated-measures Friedman ANOVA corrected for ties was used to examine the differences in symptom severity and the overall performance during NF-BCI between the active and sham LD groups.

We found that patients who received active NF-BCI had a statistically significant improvement of their voice symptoms compared to patients who had sham NF-BCI (Chi2 = 9.99, p = 0.002). Patients with active NF-BCI had significantly greater controllability of NF-BCI than patients with sham condition (Chi2 = 10.05, p = 0.002) but had no difference in their comfort, engagement, concentration, or responsiveness during the training (all Chi2 ≤ 2.6, p ≥ 0.10).

Conclusion: By integrating personalized EEG modeling, neurofeedback, and VR, this first study of adaptive closed-loop BCI intervention in LD patients demonstrated the feasibility of the treatment of this disorder, opening new opportunities for patients with LD and other focal task-specific dystonias.

Acknowledgments and Disclosures: This study was funded by the grant R01DC019353 from the National Institute on Deafness and Other Communication Disorders, National Institutes of Health, to KS. No conflict of interest for any author relevant to this study.

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RS-1-6 *Advancing speech BCIs towards conversational speeds in people with paralysis*

Kamran Hussain [1], Erin Kunz [1], Nick Hahn [1], Akansha Singh [1], Leigh Hochberg [2], Francis Willett [1], Jaimie Henderson [1]

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Intracortical speech Brain-Computer Interfaces (BCIs) have shown promise for restoring rapid communication for individuals with paralysis by decoding the neural representation of speech into text (Willett et al. 2023, Metzger et al. 2023, Card et al. 2024, Kunz et al. 2024). However, current speech BCI systems still operate at speech rates below that of typical speech, possibly because BCI participants naturally set their own pace at slower speeds (20–70 words per minute) that are approximately half that of natural conversational speech (160 words per minute) (Willett et al. 2023, Metzger et al. 2023, Card et al. 2024). We hypothesize that participants are speaking slower as a natural result of their dysarthria during articulation and vocalization. It remains unknown whether people with dysarthria can comfortably increase their speech rate when instructed to do so, and if so, whether decoding accuracy is affected by this change in preferred speech behavior. We tested the maximum speech rates achievable by BrainGate2 clinical trial participant T12, who has two 64-channel microelectrode arrays in speech motor cortex, using various verbal behaviors. Imagined speech reached conversational speeds (120-160 words per minute), while even attempted speech at higher instructed rates surpassed T12s typical pace (100 words per minute compared to her usual 60). We then tested how decoding performance varied across four attempted speaking rates using non-vocalized, mimed speech (attempted mouthed behavior): 15, 30, 60, and 120 words per minute, using an open-loop karaoke-style task (Figure 1b) to help T12 pace her speech. In offline evaluations with a limited 50-word vocabulary, we found that decoding accuracy decreased with increasing speech rate, with the optimum decoding accuracy occurring at 30 words per minute. (Figure 1c). Finally, we examined the neural correlates of speech rate and found sentences spoken at different rates were largely stretched or compressed versions of a consistent neural activity template. Encouragingly, these results suggest that, at least for the participant studied here, speaking rates can be increased substantially when instructed, and the resulting neural activity remains decodable (although accuracy declines). Additionally, the maximum speech rate for each verbal behavior indicates imagined behaviors can achieve average conversational rate while potentially being less tiring and uncomfortable, though trade-offs with decoding accuracy will need to be addressed.

Research Session 2

Thursday, June 5

2:00pm - 3:30pm

RS-2-1 *Speech decoding performance is influenced by perceiving auditory feedback or not: Implications for locked-in individuals*

Anouck Schippers [1], Julia Berezutskaya [1], Zac Freudenburg [1], Erik Aarnoutse [2], Mathijs Raemaekers [1], Mariska Vansteensel [1], Nick Ramsey [2]

[1] UMC Utrecht Brain Center, [2] University Medical Center Utrecht

RS-2-2 *Combatting percept adaptation to intracortical microstimulation in humans*

Taylor Hobbs [1], Charles Greenspon [2], Michael Boninger [1], Robert Gaunt [1]

[1] University of Pittsburgh, [2] University of Chicago

Introduction: Without tactile sensation, even simple, everyday tasks become nearly impossible [1]. Intracortical microstimulation (ICMS) in the human somatosensory cortex (S1) can restore tactile sensations by using electrical stimulation to activate sensory neurons in the brain that would normally respond to touch [2]. Typically, ICMS trains consist of unmodulated single-channel stimulation with a constant amplitude and frequency. These stimuli evoke vivid tactile percepts originating from the participants' own hands. Unfortunately, the perceived intensity of these sensations can rapidly decrease during stimulation, falling below the perceptual threshold in tens of seconds [3]. Desensitization may occur, in part, because these ICMS trains do not resemble naturally evoked neural activity.

Material, Methods and Results: Two microelectrode arrays were implanted in both the motor and somatosensory cortices of 3 participants with tetraplegia as part of a clinical trial (NCT01894802). We designed two ICMS encoding schemes leveraging biological principles: biomimetic ICMS, which mimics natural spatiotemporally modulated neural activity, and interleaved ICMS, which takes advantage of overlapping sensory fields to distribute stimulation across multiple electrodes. For biomimetic ICMS, we co-modulated frequency and amplitude (40 to 80 μA at 100 to 200 Hz) with a large but brief (200 ms) onset and offset transient stimulation bursts. For interleaved ICMS we used four electrodes with overlapping projected fields and cycled through each electrode using 200 ms of ICMS at 40 μA at 100 Hz, parameters that were above threshold for each of the four electrodes. To test percept resiliency, participants either watched a clock face and were asked to report how long the sensation lasted or used a tablet to continuously report the stimulation intensity. Stimulation durations were randomly chosen from 1 to 180 s intervals. Preliminary results show that unmodulated ICMS led to rapid adaptation, biomimetic stimulation increased the perceived duration, and interleaved ICMS completely eliminated percept adaptation (see Fig. 1, n = 7 electrodes). In fact, sensations from interleaved ICMS could be reliably felt for over a minute.

Conclusion: These experiments demonstrate that both biomimetic and interleaved ICMS encoding schemes greatly extend the perceived sensation duration compared to traditional unmodulated stimulation. These improvements likely arise from dynamic and distributed stimulation patterns, which may reduce neural adaptation. Notably, biologically inspired ICMS overcomes a critical limitation for the practical use of ICMS in restoring sensation, providing reliable and uninterrupted sensory percepts for neuroprosthetics. Future experiments will expand these experiments to additional electrodes and participants.

Acknowledgements and Disclosures: This work was supported by NIH UH3NS107714 and NDSEG Fellowship. RG is on the advisory board of Neurowired and previously consulted for Blackrock Neurotech.

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RS-2-3 *The variability of EEG spectral measures in MCS: Towards a multidimensional characterization of the awareness fluctuations*

Ilaria Quattrociocchi [1], Angela Riccio [2], Valentina Caracci [1], Valentina Galiotta [2], Mariagrazia D'ippolito [2], Emanuela Rotondo [1], Floriana Pichiorri [2], Febo Cincotti [1], Jlenia Toppi [1], Donatella Mattia [2]

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The Minimally Conscious State (MCS) is a clinical condition included within the spectrum of Disorders of Consciousness characterized by fluctuating and inconsistent retrieval of awareness. In the present study, the phenomenon of fluctuations in MCS was investigated in terms of the variability over time of multiple spectral EEG parameters extracted during a monitoring protocol from 21 MCS patients. The fluctuations were characterized as the area of the variability coefficients of the spectral indices. This measure provided a concise and robust description of the variability of the spectral indices and was correlated to the clinical severity of the disorder, thus representing a promising tool to identify and characterize fluctuations in MCS patients in order to facilitate the implementation of BCI-based systems.

RS-2-4 *Star-Burst paradigm: Implementation of an "invisible" dry-EEG reactive BCI*

Jules Gomel [1], Frédéric Dehais [1], Pietro Cimarosto [1], Kalou Cabrera Castillos [1], Juan Jesus Torre Tresols [1]

[1] *Institut Supérieur de l'Aéronautique et de l'Espace*

Code Visually Evoked Potentials (c-VEP) have become increasingly popular in the rBCI community, leveraging pseudo-random visual flickers that offer shorter calibration times compared to Steady State VEP [1]. However, the application of c-VEP-based reactive BCIs has largely remained confined to laboratory settings due to the reliance on wet EEG systems and synchronous paradigms with fixed decoding times. To address these challenges, our team used innovative repetitive visual stimuli called StAR (Stimuli for Augmented Response). These stimuli are engineered with specific, mostly invisible textures that elicit neural responses ranging from retinal ganglion cells (contrast detection) to visual cortex cells (orientation selectivity) [2]. Our StAR stimuli are activated using a burst-code VEP paradigm, featuring brief, aperiodic visual flashes presented at a slower rate of three flashes per second. This approach elicits stronger visual evoked responses compared to traditional maximum length sequences [3]. Each stimulus (e.g., a letter or digit) is presented with its own unique pseudo-random code comprising an alternating sequence of '1' (on) and '0' (off). This innovative approach dramatically reduces calibration time to under one minute, as the algorithms only need to differentiate brain responses to the presence (visual ERP) or absence of a flash (no visual ERPs).

The online StAR-Burst rBCI was developed using Timeflux framework [4]. This system was specifically designed for an 11-class classification task to predict participants' attention in real time based on visual stimuli. It utilizes a combination of XDawn spatial filtering and Riemannian-based tangent space classifiers for optimal performance. The 11 commands corresponding to the T9 keypad were encoded using 11 unique burst codes [3], carefully designed to maximize discrimination between commands. The classification pipeline was followed by a correlation-based accumulation method, allowing flexible, self-paced decoding time. Eighteen participants were equipped with an 8-channel dry EEG system (Enobio), with electrodes placed over the occipital and parieto-occipital cortex areas (PO7, O1, Oz, O2, PO8, PO3, POz, PO4) to capture visually evoked potentials (VEPs). They underwent an 40-second calibration procedure before performing an online T9 pinpad self-paced task consisting of 10 sequences, each containing four targets, resulting in a total of 40 targets per participant. The StAR-Burst rBCI demonstrated high performance, achieving a mean accuracy of 96.3% (SD = 4.79) and a mean decoding time of 4.2 seconds (SD = 5.5). A video showcasing the BCI can be seen here https://nextcloud.isae.fr/index.php/s/dxLqYXRAMEep98C.

Collectively, these findings highlight the transformative potential of StAR-Burst paradigm driving the evolution to make BCIs more user friendly and efficient. Our implementation achieved high accuracy levels with a dry EEG system, requiring only minimal calibration data (40s). This paradigm, characterized by comfort and subtle perceptibility in peripheral vision, show potential for applications in various reactive BCI paradigms such as P300 speller, SSVEP, and oddball-based BCI. The application of the proposed StAR approach may be extended beyond technological innovation to fundamental cognitive neuroscience research, providing a valuable avenue for exploring cognition.

RS-2-5 *An Evoked Potential of Vection using Passive Brain-Computer Interfaces*

Gael Van Der Lee[1], Anatole Lécuyer[2], François Cabestaing[1], Reinhold Scherer[3], Hakim Si-Mohammed[1]

[1] Université de Lille, [2] Institut National de Recherche en Informatique et en Automatique, [3] University of Essex

Introduction: Vection, the illusion of self-motion induced by visual stimuli, is a key aspect of user experience in Virtual Reality (VR), influencing both presence and cybersickness. Traditional vection measurements rely on subjective questionnaires, which are limited by their nature and inability to provide real-time. This work investigates the presence of vection markers in electroencephalogram (EEG) brain signals, specifically focusing on evoked potentials (EPs) in response to visual acceleration. Identifying an objective, real-time measure of vection can be highly impactful for adaptive passive BCI systems.

Material, Methods and Results: We designed a VR experiment that induced vection using two conditions: (1) forward acceleration (FA_1) and (2) backward acceleration (BA_1). Thirty participants experienced these accelerations while EEG signals and subjective vection reports were recorded. Participants rated their vection experience on a four-point Likert scale: “No Vection” (NV, perceived object-motion), “Weak Vection” (WV, mostly object-motion with slight self-motion), “Moderate Vection” (MV, mostly self-motion with slight object-motion), and “Strong Vection” (SV, perceived self-motion only). A novel evoked potential of vection was identified, characterized by a positive peak around 600 ms (P600) after stimulus onset in the parietal region (electrodes CP1, CPz, CP2) and a simultaneous negative peak in the frontal region (electrodes F1, Fz, F2). This EP is significantly different between trials where participants reported a strong sensation of self-motion (SV) versus trials where they reported weak or no self-motion (NV & WV). We also observed alpha suppression during perceived self-motion, replicating prior findings. The specific signal found is shown in the attached figure.

Conclusion: This study reveals a novel evoked potential of vection, occurring approximately 600ms after the onset of visual acceleration. This marker, distinct between trials with strong and weak/no vection, provides an objective and real-time measure of subjective user experience. This finding has implications for the automatic detection of vection and enabling VR environments to adapt to individual user experiences, such as implementing cybersickness mitigation techniques when vection is detected. This paves the way for a deeper understanding of the neural mechanisms underlying vection and passive BCI applications.

Acknowledgments and Disclosures: This research was funded by the European Union ERA-NET CHIST-ERA 2020 (CHIST-ERA-20-BCI-003 “GENESIS”) and the French Research Agency (ANR-21-CHRA-0001-01). The authors declare no conflicts of interest.

RS-2-6 *Long-term stability and performance of stimulation and recording in a human participant over 2,800 days*

David Bjånes[1], Sean Darcy[1], Luke Bashford[2], Kelsie Pejsa[1], Brian Lee[3], Charles Liu[3], Richard Andersen[1]

[1] California Institute of Technology, [2] Newcastle University, [3] University of Southern California

Flash Talks #1

Tuesday, June 3

3:30pm - 3:45pm

FT-1-1 *μECoG Array with 3,072 Electrodes for High-Density and Large-Area Cortical Recordings Based on Scalable Thin-Film Electronics*

Paoline Coulson[1], Sofie Luijten[2], Florian De Roose[3], Kris Myny[4], Jan Genoe[4], Sebastian Haesler[2]

[1] Katholieke Universiteit Leuven, [2] Neuro-Electronics Research Flanders, [3] Interuniversity Microelectronics Centre, [4] KU Leuven

Introduction: Large-scale neural implants, involving hundreds of electrodes and spanning multiple cortical areas, are emerging in clinics and neuroscience laboratories [1][2], however their accessibility remains limited. These technologies are based on cutting-edge flexible materials and rely on advanced integrated circuits for their acquisition, and therefore are only produced in research environments at high costs. We propose a novel system, including an industrially manufactured multi-thousand channel μECoG implant, and a commercially available acquisition tool, resulting in a full neural implant solution, easily integrated in any laboratory environment.

Material, Methods and Results: Our μECoG can simultaneously record neural signals in the 1-200 Hz ECoG bandwidth, with3,072 multiplexed electrodes. The embedded metal-oxide thin-film transistors used to switch between electrodes have previously been established by our group [3], and are now being manufactured in an industrial foundry. Moreover, we have shown their biocompatibility according to ISO standards [3]. Their new low-cost and rapid production yields scaled devices, optimized for high conformability to the brain tissue with an 18 μm thick polyimide substrate. High resolution and very high-density is achieved through iridium electrodes with 200 μm pitch and customizable size between 30*30 and 100*100 μm^2. We have developed a small headstage and flexible connectors which enable a smooth implantation of the devices. Interfacing printed circuit boards (PCBs) were designed to achieve a compact system connecting to a carefully selected standard acquisition tool for electrophysiology laboratories. Demultiplexing of the signals is performed in near real-time enabling monitoring of the signals during recordings. In-vivo experiments have shown the capability of the implant to delineate whisker movements in the somatosensory cortex of rodents and has revealed dynamics across several cortical areas.

Conclusion: The accessible μECoG system developed in this work yields unparalleled high-density recordings over large areas of the cortex. Thanks to its industrial production, the number of electrodes could be drastically increased compared to state-of-the-art implants and enables the rapid and low-cost manufacturing of the devices. Multi-thousand channel implants thus become easily accessible and can help push the boundaries of neuroprostheses.

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FT-1-2 *Mitigating EEG Non-Stationarity in Multi-Session MI BCI with Autoencoder Denoisers*

Yoav Noah [1], Oren Shriki [1]
[1] *Ben-Gurion University*

A fundamental challenge in motor imagery (MI) brain-computer interfaces (BCIs) is related to the non-stationary nature of brain signals. This inherent variability undermines the performance of classifiers, as models trained on data from one session often fail to generalize effectively to subsequent sessions. Traditionally, addressing this issue requires recalibrating the model for each session, a labor-intensive process that limits the scalability and practical deployment of BCIs in real-world applications.

FT-1-3 *Closed-loop error damping in human BCI using endogenous modifications in motor cortex activity*

Camille Gontier [1], Nicolas Kunigk [1], William Hockeimer [1], Edgar Canario [1], Linnea Endsley [2], John Downey [2], Jeffrey Weiss [1], Brian Dekleva [1], Jennifer Collinger [1]
[1] *University of Pittsburgh,* [2] *University of Chicago*

Introduction: The motor cortex is known to encode motor intents, carrying rich information about movement kinematics. Interestingly, motor cortex activity also includes an error signal, i.e. a neural correlate of erroneous motor control that does not align with the movement goal. This error signal could potentially be leveraged during real-time BCI control, to detect a discrepancy between the decoded movement and the user's intent and to perform on-the-fly error correction. Previous studies have been able to identify a neural correlate of such periods of erroneous motor control to perform on-the-fly detection of BCI control in monkeys. However, whether this signal is sufficiently robust to be used in human applications, and can generalize across realistic tasks, is still unknown. Here, we train a classifier to detect periods of erroneous motor control based on intracortical recordings from motor cortex, and use it to perform real-time error detection and control signal modulation in different BCI tasks with human participants.

Material, Methods and Results: We obtained intracortical data from 3 human participants (C2, P2, and P4) who were asked to perform a BCI 2D cursor control center-out task. Participants provided informed consent prior to enrolling in a clinical trial of an intracortical sensorimotor BCI that was approved under an FDA Investigational Device Exemption (NCT01894802). We trained a classifier to detect periods of erroneous control using data collected while the participants performed the center-out task, where "error" was defined as an increasing distance between the cursor and the target. Crucially, neural features immediately preceding the onset of an error (and which represent endogenous activity rather than responses to visual feedback) are also included in the training set, allowing earlier error detection. Then, in subsequent testing blocks, whenever the detected error probability reached a defined threshold, the system performed error modulation by reducing the decoded velocity, hence preventing the cursor from moving further away from its target. Error modulation significantly improved BCI performance on a variety of performance metrics. In individual participants, we demonstrated improved performance when applying error modulation to a more realistic and multidimensional click and drag task and to the precision task from the recent Cybathlon BCI competition, where stability is especially critical to performance.

Conclusion: Results show that motor cortex activity is significantly modified during erroneous control, and that this neural signature can be leveraged to minimize errors, hence improving BCI performance.

Acknowledgments and Disclosures: This project was supported by the Swiss NSF (grant P500PM 210800) and by the NINDS (award numbers R01NS121079 and UH3NS107714). BD and JW serve as consultants for Blackrock Neurotech, Inc.

FT-1-4 *Decoding of Lower-Limb Movement Intent from Scalp Electroencephalography (EEG) in Children*

Ayman Alamir[1], Jose Contreras-Vidal[1]

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Introduction: Brain-computer interfaces (BCIs) can be used to decode movement intent from brain signals and, thus, provide a direct communication link with external virtual or physical machines such as computers, exoskeletons or prosthetic limbs. Those signals can also be utilized to promote neuroplasticity in the central nervous system to recover motor functions. Although rehabilitation-based BCIs have been broadly applied to the adult population and showed promising results, these adult-optimized BCIs might not work well for the pediatric population. In a systematic review of children BCIs, Orlandi et al. found that only 12 publications published between 2008 and 2021 reported BCI performance. Out of those studies, only one non-invasive study addressed mobility, indicating the need for more studies in this field.

Material, Methods and Results: Two experiments were conducted. The first experiment (Cued Dataset, N=5, Age: 7.6 ± 2.3 years; single session tasks: visually-cued sit-stand transitions and walk-stop locomotion with at least 20 of each) involved visual cues to indicate the start of movement, which can be suitable for synchronous BCIs. The second experiment (Self-initiated Case Study, N=1, Age: 12 years, a total of 12 sessions collected in a course of seven weeks, Task: volitional sit-stand transitions and walk-stop locomotions with at least 20 of each) was self-triggered in terms of timing of movement and its category (Sit/Stand/Walk), which is appropriate for asynchronous BCIs. Acquisition of Electroencephalography (EEG) and electromyography (EMG) data was synchronized. To characterize EEG, the time-locked signals were processed for offline analysis. To close the loop and implement a real-time BCI, two types of state-dependent classification models were built for decoding movement intent from EEG and predicting the next transition. Two pipelines for pre-processing EEG data before utilizing them as an input to neural networks for classification were tested: one with the adaptive noise cancelling H-infinity filter, and the other with an ICA-based spatial filter designed to decompose EEG into independent sources. The convolutional neural networks implemented for training, validation, and real-time testing are composed of normalization, 1-D temporal convolution, rectifying linear unit, self-attention, fully connected, and SoftMax layers. Sensitivity analysis was performed with the input to the neural networks altered in terms of duration, frequency, and channels. For the offline analysis, movement related cortical potentials are observed clearly, especially in the channels closer to the central areas. Event-related spectral perturbation analysis indicates that all movement classes show a large decrease in power in the δ band. Moreover, an increase in power in the lower δ band starts to appear about one second before the movement onset. ICA and EEG dipole source localization investigation revealed the involvement of Brodmann Areas 6 and 8, areas known for their roles in motor planning, learning, and control. The sensitivity test results highlight the significance of the δ-band and window duration of 2 seconds for decoding. To investigate the capability of decoders to detect movement intent from single trials coming from completely an unseen session, models were trained on data from sessions 1 through 11 of the Case Study and tested on session 12. Overall, the mean F1-Score of the Seated Model was 0.80 (chance level≃0.5) whereas it was 0.54 for the Standing Model (chance level≃0.3).

Conclusion: This study demonstrates the feasibility of using EEG signals to predict movement intent in children for synchronous and asynchronous BCIs. EEG preceding movement onset was characterized in time, frequency, and IC domains. A prototype BCI based on the outcomes of this research was developed and evaluated. The findings of this research could substantially assist in developing pediatric BCIs that are capable of controlling walking exoskeletons and, consequently, improving their users' motor control. This work also promotes access of BCI systems to pediatric populations.

Acknowledgments and Disclosures: Funded in part by NSF IUCRC BRAIN award #2137255 and a doctoral fellowship offered to ASA by Jazan University.

Flash Talks #2

Thursday, June 5

3:30pm - 3:45pm

FT-2-1 *Decoding of Directional Auditory Attention Shifts in Multi-Talker Environments Using EEG Alpha Power*

Gabriel Ivucic[1]

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Introduction: Selective auditory attention refers to the ability to focus on relevant sound sources in environments with competing noises, known as the cocktail-party effect. Although previous work has established that attentional selection of speakers can be decoded from EEG, attention switching between speakers is less well studied under realistic, conversation-like conditions. This study investigates auditory attention switching in a multi-talker environment, focusing on neural changes associated with switching attention and decoding the switching direction from EEG.

Material, Methods and Results: We conducted an experiment in a simulated multi-speaker setting with 20 participants, who selectively attended to one of two target speakers (at -30° and 30° in front of the participant), and switched between them during turn-taking exchanges while ignoring 2 background distractor speakers (at -90° and 90°). EEG data were recorded during 36 trials, each lasting approximately 70 seconds and consisting of 4 natural speech segments with 3 exogenous attention switches in between. After manual trial exclusion, ICA, and channel interpolation, we analyzed alpha power progression within a ±12-second window around the switch. Reduced parietal alpha was observed immediately following attention switches, peaking around 2 seconds post-switch and returning to baseline after 5 seconds (Figure 1). Separating the data by shifts in attention to the left or right and averaging alpha power over 5-second pre- and post-event windows revealed an ipsilateral parietal alpha reduction corresponding to the direction of attention switching ($p < 0.05$, Bonferroni corrected for 62 channels, Wilcoxon signed-rank test), consistent with previous findings. To test whether attention-switching direction could be decoded from these alpha power deflections, a subject-dependent linear discriminant analysis (LDA) with 5-fold cross-validation was performed on 5-second post-event windows. The LDA achieved an average accuracy of 87.4% (SD: 2.48%), as shown in Figure 2, significantly exceeding the binomial confidence interval upper limit of 60.47% for each participant ($p = 0.51$, $n = 108$ samples).

Conclusion: EEG analysis revealed alpha power changes in parietal regions linked to the direction of attention switching. LDA classification showed high accuracy in decoding the direction of auditory attention shifts. These results advance the understanding of the neural basis of auditory attention in multi-talker scenarios, supporting the development of attention-based brain-computer interfaces and smart hearing aid technologies.

FT-2-2 *Decoding gestures from intracortical neural activity in ventral precentral gyrus*

Elizaveta Okorokova [1], Tyler Singer-Clark [1], Nicholas Card [1], Carrina Iacobacci [1], Hamza Peracha [1], Leigh Hochberg [2], David Brandman [1], Sergey Stavisky [1]

[1] *University of California, Davis,* [2] *Brown University*

Introduction: Intracortical brain-computer interfaces (iBCIs) can restore communication for individuals with paralysis by decoding their motor intent from neural signals and performing computer actions. Recently, we showed that precentral gyrus encodes a broad range of body movements/gestures and speech in a widely distributed manner [1,2]. Following this observation, in this study we integrated gesture decoding with computer cursor control driven by electrodes in ventral (speech) motor cortex with the goal of introducing discrete assistive computer actions, such as mouse right-click, scroll, copy/paste, etc. into an existing multimodal cursor and speech neuroprosthesis framework.

Material, Methods and Results: One participant with ALS was implanted with 4 Utah arrays in precentral gyrus (areas 4, 6v and 55b) [3,4]. We first collected a dataset examining the neural representation of 60 broadly sampled body movements, with a specific focus on hand and face (Figure 1a). Neural responses exhibited distinguishable signatures for most attempted body movements (Figure 1b), and these movements could be reliably decoded from the neural data (Figure 1c). Next, we selected a set of 2, 3, or 4 movements and asked the participant to perform a multi-gesture cursor and click task, in which the participant moved a cursor towards a target and then attempted a cued gesture to select it (Figure 1d). We observed significant neural modulation to both cursor direction and attempted gesture. Signals from all arrays contributed significantly to gesture decoding (Figure 1e). Cursor movement and gestures were decoded in real time as described in [3], and the participant achieved closed-loop decoding accuracy of 91%, 89% and 80% for 2, 3 and 4 gestures, respectively.

Conclusion and future work: We showed that gestures can be decoded from neural activity in cortical areas 6v, 4 and 55b in a closed-loop task. Next, we will integrate gesture decoding into personal computer use to allow flexible and intuitive mapping between attempted gesture and computer actions.

Acknowledgments and Disclosures: We thank participant T15 and his family for their valuable time and contribution to science. S.D.S. is a scientific advisor to Sonera, D.M.B. is a surgical consultant to Paradromics, L.R.H. is a consultant to Paradromics, Neuralink, Synchron, Axoft, Precision Neuro, Reach Neuro, Blackrock Neurotech. T.S-C, S.D.S and D.M.B have patents and/or patent applications.

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FT-2-3 *A multifunctional speech and movement intracortical brain-computer interface for communication*

Samuel Nason-Tomaszewski[1], Yunnuo Zhang[2], Anna Pritchard[3], Brandon Jacques[3], Yahia Ali[3], Mattia Rigotti-Thompson[3], Payton Bechefsky[1], Leigh Hochberg[4], Nicholas Au Yong[3], Chethan Pandarinath[3]

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Introduction: Intracortical brain-computer interfaces (iBCIs) have enabled people with tetraplegia or dysarthria to control computer cursors and communicate rapidly with high performance. However, with recent evidence that movements of any body part are represented everywhere in precentral gyrus (PCG), a common iBCI implant target, it remains unknown whether a person can use multiple iBCI functions simultaneously. Here, we explore whether a person with tetraplegia and dysarthria can use brain-to-text (via attempted speaking) and cursor control (via intended hand movements) iBCIs simultaneously.

Material, Methods and Results: We recorded spiking activity from participant T16 (BrainGate2, ClinicalTrials.gov: NCT00912041), a 52 year old female with chronic tetraplegia and dysarthria due to a pontine stroke. We placed four 64-channel NeuroPort intracortical microelectrode arrays: two in dorsal PCG (hand knob, putative area 6d via Human Connectome Project cortical parcellation), one in ventral PCG (speech, putative area 6v), and one in middle PCG (putative areas PEF/55b). T16 performed variations of an instructed-delay radial target task that included miming (attempted mouthing without vocalization) and finger movement components (her preferred imagery for cursor control). In an open-loop form of the task, T16 attempted finger movements to follow a cursor's trajectory to one of 5 targets (up, down, left, right, or no movement), during which an intermediate target was presented with one of five speaking conditions (say "bring," "help," "nurse," "where", or say nothing). The intermediate target cued T16 to mime the indicated word when the cursor hit it, motivating simultaneous speech and movement. Peri-stimulus time histograms (PSTHs) and cross-validated signal-to-noise ratios (cvSNRs; measure separability relative to "do nothing"; 0 means no separability) showed arrays strongly preferred the behavior expected by somatotopy. Ventral PCG electrodes were strongly modulated to miming and not movement (2.61 and 0.751 cvSNR, respectively) and dorsal PCG electrodes were strongly modulated to movement and not miming (1.68 and 0.845 cvSNR, respectively), both as expected. Perhaps surprisingly, middle PCG electrodes were modulated for both miming and movement (2.00 and 1.64 cvSNR, respectively). In a closed-loop form of the task involving 8 targets and words from a 125k-word vocabulary, we found controlling the cursor while miming yielded minutely, yet significantly higher total acquisition times (2.59s without miming vs. 2.98s with, $p < 0.01$) and an insignificant increase in phoneme error rate (55% without cursor vs. 60% with, $p = 0.04$). With substantial distinction between cursor- and miming-related control signals, T16 was able to complete a simultaneous speech and cursor control task which involved using the speech BCI to write sentences generated from a 125k-word vocabulary and using the cursor to select any words the speech BCI predicted incorrectly.

Conclusion: These results provide promising evidence that iBCI users may be able to control multiple functions simultaneously during unstructured personal use.

Acknowledgments and Disclosures: The authors would like to thank participant T16 and her family and care partners for their contributions to this research, as well as Y. Bamps, H. Rashid, C. Spellen, M. Masood, D. Rosler, and B. Davis for administrative and clinical research support. This work was supported by NIH DP2NS127291, F32HD112173, T32EB025816, and U01DC017844 and Veterans Affairs RR&D A2295-R. The Massachusetts General Hospital (MGH) Translational Research Center has a clinical research support agreement (CRSA) with Axoft, Neuralink, Neurobionics, Paradromics, Precision Neuro, Synchron, and Reach Neuro, for which LRH provides consultative input. LRH is a non-compensated member of the Board of Directors of a nonprofit assistive communication device technology foundation (Speak Your Mind Foundation). Mass General Brigham (MGB) is convening the Implantable Brain-Computer Interface Collaborative Community (iBCI-CC); charitable gift agreements to MGB, including those received to date from Paradromics, Synchron, Precision Neuro, Neuralink, and Blackrock Neurotech, support the iBCI-CC, for which LRH provides effort. CP is a research scientist at Meta (Reality Labs).

FT-2-4 *Bimanual BCI: Combining a brain-controlled hand exoskeleton with the functional limb*

Satyam Kumar [1], Kanishka Mitra [2], Ruofan Liu [1], Hussein Alawieh [1], Akhil Surapaneni [1], Ashish Deshpande [3], José Del R. Millán [1]

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Brain-controlled robotic systems have demonstrated promise as personalized assistive tools [1]. Yet current BCIs largely focus on unilateral exoskeletons for basic functions [2], offering limited utility in real-world tasks demanding bilateral coordination. This is critical for individuals with unilateral motor impairments, who could combine a BCI-controlled exoskeleton for the affected limb with overt motor actions of the healthy limb. Although the motor cortex supports simultaneous movements, non-invasive electroencephalogram (EEG)-based BCIs remain understudied in this context [3]. Here we show that a BCI decoder trained on a unimanual task can be reliably transferred to more complex bimanual tasks without requiring bimanual-specific calibration.

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Poster Sessions

SESSION 1 Tuesday, June 3 3:45pm - 5:45pm
SESSION 2 Wednesday, June 4 4:00pm - 6:00pm
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The poster boards are organized in the following manner: Session – Theme – Board # (i.e. P1-A-01)

BCI AREAS

- **A** **Implantable BCIs – Basic Science, Methods, and Technology**
- **B** **Implantable BCIs – Control Applications**
- **C** **Implantable BCIs – Other Applications**
- **D** **Non-implanted BCIs – Basic Science, Methods, and Technology**
- **E** **Non-implanted BCIs – Control Applications**
- **F** **Non-implanted BCIs - Other Applications**
- **G** **Signal Analysis, Simulation, Machine Learning, and AI**
- **H** **User Factors, Experiences & Ethics**

SESSION 1

Tuesday, June 3 3:45pm - 5:45pm

P1-A-01 ***A Novel Fully Implantable High Data Rate BCI for Speech Restoration***

David Brandman [1], Vikash Gilja [2], Shaoyu Qiao [2], Matthew Angle [2]

[1] University of California, Davis, [2] Paradromics, Inc.

P1-A-02 ***Dynamic Class Balancing for Real-time Decoder Learning***

Rémi Souriau [1], Félix Martel [2], Tetiana Aksenova [1]

[1] Commissariat à l'énergie atomique et aux énergies alternatives, [2] Université Grenoble Alpes

P1-A-03 ***Intracortical neural representation of finger movements in a nonhuman primate preserved over 400 days***

Matthew Mender [1], Hisham Temmar [1], Joseph Costello [1], Cynthia Chestek [1], Matthew Willsey [1]

[1] University of Michigan

P1-A-04 ***Neural control of a robotic hand prosthesis by posture-related activity in the grasping circuit***

Hunaid Hameed [1], Andres Agudelo-Toro [1], Marco Controzzi [2], Hans Scherberger [1]

[1] German Primate Center, [2] The Biorobotics Institute, Scuola Superiore Sant'Anna

P1-A-05 ***Decoding hierarchical elements of language from speech motor cortex to restore communication for people with ALS***

Hadar Levi Aharoni [1], Justin Jude [1], Shane Allcroft [2], Alex Acosta [1], Stephanie Haro [2], Nicholas Card [3], Maitreyee Wairagkar [3], Carrina Iacobacci [3], David Brandman [3], Sergey Stavisky [3], Sydney Cash [1], Ziv Williams [4], John Simeral [2], Leigh Hochberg [2], Daniel Rubin [1]

[1] Massachusetts General Hospital, [2] Brown University, [3] University of California, Davis, [4] Massachusetts General Hospital & Harvard Medical School

P1-A-06 ***Decoding of Coordinated Hand and Arm Movements***

Mark Iskarous [1]

[1] University of Chicago

P1-A-07 ***Closed Loop Decoding of Ipsilateral and Contralateral Proximal Movements in an Individual with Tetraplegia***

Kushaal Rao [1], Henry Jenkins [1], Ruixiang Li [1], Maarten Ottenhoff [1], Richard Cheng [1], Alex Acosta [2], Bayardo Lacayo [2], Lucille Panagos [2], Shane Allcroft [1], Andrew Dempsey [2], Carlos Vargas-Irwin [1], Leigh Hochberg [1]

[1] Brown University, [2] Massachusetts General Hospital

P1-A-08 ***An intuitive, bimanual, high-throughput QWERTY keyboard touch typing neuroprosthesis***

Justin Jude [1], Hadar Levi Aharoni [1], Alex Acosta [1], Shane Allcroft [2], Nicholas Card [3], Maitreyee Wairagkar [3], David Brandman [3], Sergey Stavisky [3], Ziv Williams [4], John Simeral [2], Leigh Hochberg [2], Daniel Rubin [1]

[1] Massachusetts General Hospital, [2] Brown University, [3] University of California, Davis, [4] Massachusetts General Hospital & Harvard Medical School

P1-A-09 ***A biomimetic iBCI decoder for restoring hand function in people with spinal cord injury***

Fabio Rizzoglio [1], Maximilian Carvajal [1], Pouyan Firouzabadi [2], Vikram Darbhe [3], Alexandriya Emonds [4], Anton Sobinov [4], Giacinto Luigi Cerone [5], Alberto Botter [5], Nina Suresh [3], Wendy Murray [1], Lee Miller [1]

[1] Northwestern University, [2] Northwestern University, [3] Shirley Ryan Ability Lab, [4] University of Chicago, [5] Politecnico di Torino

P1-A-10 *EEG-based correlates of attention in intracortical BCI motor tasks*

Edgar Canario [1], Murat Akcakaya [1], Douglas Weber [2], Jennifer Collinger [1]

[1] University of Pittsburgh, [2] Carnegie Mellon University

P1-A-11 *Proprioceptive and Visual Feedback Effects on iBCI Decoding of Hand Grasps*

Jake Gusman [1], Diogo Schwerz De Lucena [2], Tommy Hosman [1], Anastasia Kapitonava [3], Claire Nicolas [3], Alex Acosta [3], Diana Wagner [4], Daniel Rubin [3], John Simeral [1], Carlos Vargas-Irwin [1], Conor Walsh [4], Leigh Hochberg [1]

[1] Brown University, [2] AE Studio, [3] Massachusetts General Hospital, [4] Harvard University

P1-A-12 *Development and Validation of a Fully Implantable Brain-Computer Interface System*

Kai Tao [1], Huijuan Chen [1], Qiangpei Fu [1], Ling Yu [1], Guoliang Yi [1], Hongjun Zheng [1], Xiliang Guo [1], Bin Zhao [1], Zhenliang He [1], Yifan Huang [1], Jing Jia [1], Yulei Chen [1], Yue Lu [1], Songwei Sun [1], Longda Wang [1], Wen Gu [1], Jiayi Lu [1], Enzhao Wang [1], Cai Zhao [1], Yu Jiang [1], Liangliang Ju [1], Jinpeng Lyu [1], Xuqian Shi [1], Wenxia Zhang [1], Dandan Cao [1], Mingxin Li [1], Zhihua Li [1], Zipei Shuai [1], Congcong Zhang [1], Jiawei Ju [1], Ji Mu [1], Zhicheng Shi [1], Wei Wang [1], Guang Xiong [1], Han Yang [1], Zhenda Zhang [1], Yu Zhou [1], Dan Li [1], Hao Li [1], Le Song [1], Jie Sun [1], Ming Tian [1], Shibin Wei [1], Lili Bu [1], Yafei Cui [1], Hongxiong Jiang [1], Fei Wang [1], Lei Wu [1], Qing Xu [1], Han Wang [1], Xi Jiang [1], Ruoyu Li [1], Shi Wang [1], Jingli Han [1], Shouliang Guan [1], Ning Xue [1], Lei Yao [1], Chengyu Li [1]

[1] Lin Gang Laboratory

P1-A-21 *µECoG Array with ^{3},072 Electrodes for High-Density and Large-Area Cortical Recordings Based on Scalable Thin-Film Electronics*

Paoline Coulson [1], Sofie Luijten [2], Florian De Roose [3], Kris Myny [4], Jan Genoe [4], Sebastian Haesler [2]

[1] Katholieke Universiteit Leuven, [2] Neuro-Electronics Research Flanders, [3] Interuniversity Microelectronics Centre, [4] KU Leuven

P1-B-24 *Closed-loop error damping in human BCI using endogenous modifications in motor cortex activity*

Camille Gontier [1], Nicolas Kunigk [1], William Hockeimer [1], Edgar Canario [1], Linnea Endsley [2], John Downey [2], Jeffrey Weiss [1], Brian Dekleva [1], Jennifer Collinger [1]

[1] University of Pittsburgh, [2] University of Chicago

P1-B-25 *Advancing speech BCIs towards conversational speeds in people with paralysis*

Kamran Hussain [1], Erin Kunz [1], Nick Hahn [1], Akansha Singh [1], Leigh Hochberg [2], Francis Willett [1], Jaimie Henderson [1]

[1] Stanford University, [2] Brown University

P1-B-26 *From ECoG signals to cervical epidural electrical stimulation: Restoring arm and hand movements after a spinal cord injury*

Thibault Collin [1], Ina Bianca Yu [1], Icare Sakr [2], Valeria Spagnolo [3], Sergio Daniel Hernandez Charpak [1], Nadine Intering [1], Julie Hervé [1], Céline Deschenaux [1], Gaia Carparelli [1], Felix Martel [4], Rémi Souriau [4], Alice Bruel [1], Pedro Abranches [1], Nicolas Hankov [1], Grégory Dumont [1], Pierre Bessot [5], Charlotte Jacquet [5], Anne Watrin [1], Léa Bole-Feysot [1], Charles David Sasportes [1], Malo Simondin [1], Cathal Harte [1], Serpil Karakas [4], Laure Coquoz [1], Vincent Rouanne [1], Federico Ciotti [1], Simon Dahan [1], Frédéric Merlos [1], Philippe Forrero [1], Rémy Tang [1], Andrea Galvez [1], Jean-Baptiste Ledoux [6], Camille Haxaire [1], Carole Poulin [1], Fabio Becce [6], Stefano Carda [6], Viviana Aureli [1], Matthieu Bosquet [7], Marina D'ercole [5], Julien Dedelley [5], Leonie Asboth [1], Robin Demesmeaker [1], Fabien Sauter [7], Olivier Faivre [4], Tetiana Aksenova [8], Guillaume Charvet [7], Jocelyne Bloch [9], Gregoire Courtine [9], Henri Lorach [2]

[1] NeuroRestore, [2] École Polytechnique Fédérale de Lausanne, [3] University of Lausanne, [4] Commissariat à l'énergie atomique et aux énergies alternatives, [5] Onward Medical, [6] Centre Hospitalier Universitaire Vaudois, [7] Université Grenoble Alpes, [8] Commissariat à l'Énergie Atomique et aux Énergies Alternatives, [9] Defitech Center for Interventional Neurotherapies

P1-B-27 *Navigating the clinical trial pathway for implantable brain-computer interfaces: The COMMAND study*

Thomas Oxley [1], Shahram Majidi [2], Raul Nogueira [3], Elad Levy [4], David Lacomis [5], Amit Kandel [6], Noam Harel [2], David Putrino [2], Douglas Weber [7]

[1] Synchron, [2] Icahn School of Medicine at Mount Sinai, [3] University of Pittsburgh Medical Center, [4] State University of New York at Buffalo, [5] University of Pittsburgh, [6] University of Buffalo, [7] Carnegie Mellon University

P1-A-13 *The Impact of Directed Attention on ICMS in Human Somatosensory and Motor Cortex*

Ali Alamri [1], Natalya Shelchkova [1], Nicholas Hatsopoulos [1], Charles Greenspon [1]

[1] University of Chicago

P1-A-14 ***A preliminary evaluation of a fully implantable speech BCI***

Guillaume Saldanha [1], Mohamed Baha Ben Ticha [1], Clément Arvis [1], Philémon Roussel [1], Florent Bocquelet [1], Gaël Le Godais [1], Marc Aubert [1], Thomas Costecalde [2], Lucas Struber [2], Guilaume Charvet [2], Philippe Kahane [1], Stephan Chabardes [1], Blaise Yvert [1]

[1] Université Grenoble Alpes, [2] Commissariat à l'énergie atomique et aux énergies alternatives,

P1-A-15 ***Quantizing the Growth in Clinical Trials for Implanted Brain-Computer Interfaces Addressing Motor, Sensory, and Communication Applications.***

K. Michelle Patrick-Krueger [1], Ian Burkhart [2], Jose Contreras-Vidal [3]

[1] Texas Institute of Restorative Neurotechnologies, [2] BCI Pioneers, [3] University of Houston

P1-A-16 ***An efficient protocol to optimize ICMS encoding of artificial sensation***

Samuel Senneka [1], Maria Dadarlat [1]

[1] Purdue University

P1-A-17 ***Investigation on the material-tissue-interface of flexible epicortical electrode arrays in a ferret animal model***

Thomas Stieglitz [1], Ioana Georgina Vasilas [1], Jennifer Schulte [1], Paul Cvancara [1], Florian Pieper [2], Andreas K. Engel [2]

[1] University of Freiburg, [2] University Medical Center Hamburg-Eppendorf

P1-A-18 ***A novel method for visual cortical prosthesis***

Ra'anan Gefen [1]

[1] CortiSight Medical Ltd.

P1-A-19 ***DBS-evoked ECoG responses in depression: First characterization and possible implications for closed-loop applications***

Joana Pereira [1], Matthias Dold [2], Bastian Sajonz [1], Michael Tangermann [2], Volker Arnd Coenen [1]

[1] University Medical Center of Freiburg, [2] Radboud University

P1-A-20 ***Representation of syntax in intracortical inferior frontal gyrus signals***

Tianhao Lei [1], Prashanth Prakash [1], Crispin Foli [2], A. Bolu Ajiboye [2], Joshua Glaser [1], Marc Slutzky [1]

[1] Northwestern University, [2] Case Western Reserve University

P1-A-21 ***μECoG Array with 3,072 Electrodes for High-Density and Large-Area Cortical Recordings Based on Scalable Thin-Film Electronics***

Paoline Coulson [1], Sofie Luijten [2], Florian De Roose [3], Kris Myny [4], Jan Genoe [4], Sebastian Haesler [2]

[1] Katholieke Universiteit Leuven, [2] Neuro-Electronics Research Flanders, [3] Interuniversity Microelectronics Centre, [4] KU Leuven

P1-B-22 ***A Continuously Learning Neural Decoder for Versatile and Transferable Motor Control***

Paul Weger [1], Maxime Verwoert [1], Maarten Ottenhoff [2], Sophia Gimple [1], Pieter Kubben [3], Christian Herff [1]

[1] Maastricht University, [2] Brown University, [3] Maastricht University Medical Center

P1-B-23 ***Toward Home-Use BCIs: Development and Evaluation of ECoG WIMAGINE Neuroprosthesis***

Lucas Struber [1], Félix Martel [2], Andres Carvallo Pecci [2], Rémi Souriau [2], Violaine Juillard [2], Serpil Karakas [2], Matthieu Bosquet [2], Fabien Sauter [2], Joe Saad [2], Adrian Evans [2], Stephan Chabardes [2], Tetiana Aksenova [1], Guillaume Charvet [2]

[1] Commissariat à l'énergie atomique et aux énergies alternatives, [2] Université Grenoble Alpes,

P1-B-24 ***Closed-loop error damping in human BCI using endogenous modifications in motor cortex activity***

Camille Gontier [1], Nicolas Kunigk [1], William Hockeimer [1], Edgar Canario [1], Linnea Endsley [2], John Downey [2], Jeffrey Weiss [1], Brian Dekleva [1], Jennifer Collinger [1]

[1] University of Pittsburgh, [2] University of Chicago

P1-B-28 ***Intracortical voice synthesis neuroprosthesis to restore expressive speech to an individual with ALS***

Maitreyee Wairagkar [1], Nicholas Card [1], Tyler Singer-Clark [1], Xianda Hou [1], Carrina Iacobacci [1], Lee M. Miller [1], Leigh Hochberg [2], David Brandman [1], Sergey Stavisky [1]

[1] University of California, Davis, [2] Brown University

P1-B-29 ***Simultaneous independent control of two cursors on the first day of intracortical BCI use by a participant with microelectrode arrays in bilateral precentral gyri.***

Maarten Ottenhoff [1], Ruixiang Li [1], Tsam Kiu Pun [1], Shane Allcroft [1], Andrew Dempsey [2], Alex Acosta [2], Bayardo Lacayo [2], Lucille Panagos [2], Carlos Vargas-Irwin [1], Leigh Hochberg [1]

[1] Brown University, [2] Massachusetts General Hospital

P1-D-30 ***Integrating BCI, FES, and social media for Rehabilitation of Upper Extremity Motor Function in Youth***

Anna Bourgeois [1], Meghan Maiani [1], Araz Minhas [1], Brian Irvine [1], Ion Robu [2], Payton Shaw [1], Dejana Nikitovic [3], Zeanna Jadavji [1], Gregory Wilding [2], Nathan Brand [2], Mateo Ambrogiano [2], Emily Schrag [1], Nicole Romanow [1], Adam Kirton [1], Eli Kinney-Lang [1]

[1] University of Calgary, [2] Alberta Children's Hospital, [3] University of Alberta & University of Calgary

P1-D-31 ***Decoding of Lower-Limb Movement Intent from Scalp Electroencephalography (EEG) in Children***

Ayman Alamir [1], Jose Contreras-Vidal [2]

[1] UH, [2] University of Houston

P1-D-32 ***Real-Time BCI Control of a Virtual Third Arm***

Gilad Schrift [1], Nitzan Censor [2]

[1] Tel Aviv University, [2] National Institutes of Health (NIH)

P1-D-33 ***Imagined Phoneme Decoding and Protocol Optimization for Non-invasive EEG-based Speech BCIs***

Ziyue Zhu [1], Rishan Patel [1], Emmanuel Garrison-Hooks [1], Youngjun Cho [1], Tom Carlson [1]

[1] University College London

P1-D-34 ***EEG Data Segmentation Inducing Performance Overestimation***

Nazmun Nahar Khan [1], Taylor Sweet [1], Chase Harvey [1], Calder Knapp [1], Dean Krusienski [2], David Thompson [1]

[1] Kansas State University, [2] Virginia Commonwealth University

P1-D-35 ***Neural Symbolic Regression for Interpretable & Efficient Brain- Computer Interfaces***

Araz Minhas [1], Eli Kinney-Lang [1], Adam Kirton [1]

[1] University of Calgary

P1-D-36 ***Unsupervised Manifold Stabilization Method for Across- Session Brain-Computer Interface Decoding***

Mohammadali Ganjali [1], Abed Khorasani [2], Alireza Mehridehnavi [1]

[1] Isfahan University, [2] Northwestern University

P1-D-37 ***Simulated online typing performance in a cBCI using different language models***

Tab Memmott [1], Dylan Gaines [2], Matthew Lawhead [3], Daniel Klee [3], Barry Oken [3], Keith Vertanen [2]

[1] Oregon Health and Sciences University (OHSU), [2] Michigan Technological University, [3] Oregon Health & Science University

P1-D-39 ***Adaptive Closed-Loop Neurofeedback Brain-Computer Interface for Treatment of Laryngeal Dystonia***

Jimmy Petit [1], Stefan Ehrlich [1], Garrett Tougas [2], Jacob Bernstein [2], Nicole Buie [2], Kristina Simonyan [1]

[1] Harvard Medical School, [2] Mass Eye and Ear

P1-D-40 ***EEG-based Motor Imagery Neurofeedback Enhance Mu Suppression during Motor Attempt in Stroke Patients***

Hyunmi Lim [1], Jeonghun Ku [1], Won-Seok Kim [2]

[1] Keimyung University, [2] Seoul National University Bundang Hospital

P1-D-41 ***Exploring fNIRS-guided neurofeedback to alleviate motor symptoms: A proof-of-concept study in Parkinson's disease and healthy older adults***

Franziska Klein [1]

[1] OFFIS e.V. Institute for Information Technology

P1-D-42 ***Too busy to feel? Studying the impact of workload on visuo-tactile perception through EEG***

Emile Savalle [1], Léa Pillette [2], Kyungho Won [3], Ferran Argelaguet [1], Anatole Lécuyer [1], Marc J-M Macé [1]

[1] Institut National de Recherche en Informatique et en Automatique, [2] Université de Rennes [1], [3] Gwangju Institute of Science and Technology (GIST)

P1-D-43 ***An Innovative Method for Detecting P300 Signals in Patients with Disorders of Consciousness***

Luigi Bianchi [1], Francesca Frisardi [1], Fabrizio Cum [1], Laura Mattioli [1], Francesca Leonardis [1]

[1] Tor Vergata University

P1-D-44 ***Brain-Computer Interface Games for Cognitive Assessment: A Scoping Review***

Munirah Alsubaie [1]

[1] University of Alberta

P1-D-45 ***Comparative covariance example selection: A weak labelling approach to MI BCI classification***

Alexander Thomas [1], Tom Carlson [1]

[1] University College London

P1-D-46 ***Physiologic Manifestations of Communication & Learning in a Patient with Remote TBI & Disorders of Consciousness: Lessons from Establishing a Non-Invasive BCI Protocol***

Siulam Koo [1], Arthur Yan [1], Amber Lieto [2], Sarah Baker [1], Evelyn Mariperisena-Meinert [2], Amy Bauer [1], Gary Galang [1], Nabela Enam [3], Kevin Franzese [1], Katharine "Katya" Hill [2], Amy Wagner [1]

[1] University of Pittsburgh Medical Center, [2] University of Pittsburgh, [3] University of Pennsylvania

P1-D-47 ***Designing an Eye-Gaze Tracking System with Computer Vision to Enhance Children's Intention in BCI***

Ludymila Ribeiro Borges [1], Eli Kinney-Lang [1], Adam Kirton [1]

[1] University of Calgary

P1-D-48 ***Perceptogram: Reconstructing Visual Percepts from EEG***

Teng Fei [1], Ian Jackson [1], Abhinav Uppal [1], Virginia R. De Sa [1]

[1] University of California, San Diego

P1-D-49 ***Building a taxonomy of variability factors in active BCI***

Pauline Dreyer [1], Fabien Lotte [1], Raphaëlle Nina Roy [2]

[1] Institut National de Recherche en Informatique et en Automatique, [2] École Nationale de l'Aviation Civile

P1-D-50 ***Challenges in Common Spatial Pattern Reliability for Neurofeedback***

Cassandra Dumas [1], Claire Dussard [1], Nathalie GEORGE [2], Marie-Constance Corsi [1]

[1] Sorbonne Université, [2] Centre National de la Recherche Scientifique

P1-D-51 ***Consumer grade in-ear EEG for at home pediatric BCI***

Adam Luoma [1], Adam Kirton [1], Eli Kinney-Lang [1]

[1] University of Calgary

P1-D-52 ***Smart Gel-Enabled EEG Systems for Brain-Computer Interfaces in Children with Profound Motor Impairments***

Zhitong Lin [1], Eli Kinney-Lang [2], Hyun-Joong Chung [1]

[1] University of Alberta, [2] University of Calgary

P1-D-53 ***Semantic Decoding Advances in BCI via the Novel Graded Inventory of Semantic Triggers (GIST)***

Joshua Podmore [1]

[1] University of Essex

P1-D-54 ***Identifying Brain Activity Biomarkers For Cognitive Skills In Children Aged [7] To [1]2 Years Using The EPOC X Mobile EEG***

Theo Marchand [1]

[1] Ecole des Mines de Saint Etienne

P1-E-56 ***Mitigating EEG Non-Stationarity in Multi-Session MI BCI with Autoencoder Denoisers***

Yoav Noah [1], Oren Shriki [1]

[1] Ben-Gurion University

P1-E-57 ***Evaluation of a P300 BCI for augmentative and alternative communication in children with disabilities***

Jason Leung [1], Tom Chau [2]

[1] Holland Bloorview Kids Rehabilitation Hospital, [2] University of Toronto

P1-E-58 ***Self-Correcting Multi-Command Brain-Computer Interfaces based on Error-Related Potentials***

Miriam Zacksenhouse [1], Tamar Shavit [1], Miri Benyamini [1], Igor Demchenko [1]

[1] Technion

P1-E-59 ***Genetic Algorithm Implementation for Intersubject Motor Imagery Classification***

Cristofher Toledo [1]

[1] Instituto Nacional de Astrofísica, Óptica y Electrónica

P1-E-60 ***Impact of responsiveness fluctuations on P300-based classification: An offline study for BCI applications in DoC***

Valentina Caracci [1], Angela Riccio [2], Ilaria Quattrociocchi [1], Valentina Galiotta [2], Floriana Pichiorri [2], Jlenia Toppi [1], Febo Cincotti [1], Donatella Mattia [2]

[1] Sapienza University of Rome, [2] Fondazione Santa Lucia

P1-E-61 ***Neurophysiologically-guided optimization of neuronal avalanches for BCI***

Camilla Mannino [1], Mario Chavez [2], Marie-Constance Corsi [1]

[1] Institut National de Recherche en Informatique et en Automatique, [2] Centre National de la Recherche Scientifique

P1-E-62 ***Supporting the user learning process in MI-BCI based on backward adaptation and neurofeedback***

Victoria Peterson [1], Catalina Galván [2], Valeria Spagnolo [3], Solange Gualpa [2], Denise Nigro [2], Diego H. Milone [4], Ruben Daniel Spies [2]

[1] Consejo Nacional de Investigaciones Científicas y Técnicas, [2] IMAL Instituto de Matemática Aplicada del Litoral, [3] University of Lausanne, [4] Instituto de Investigación en Señales, Sistemas e Inteligencia Computacional (sinc(i))

P1-E-63 ***Design of a Visual BCI for Children With Cerebral Palsy to Operate a Power Mobility Device***

Danielle Jourdain [1], Haden Scheirman [1], Philippa Madill [1], Aleksander Berezowski [1], Morgan Kerr Mcnutt [1], Liam Workman [1], Adam Kirton [1], Ludymila Ribeiro Borges [1], Adam Luoma [1], Eli Kinney-Lang [1]

[1] University of Calgary

P1-E-64 ***Enhancing destination-based BCI navigation using reinforcement learning and large language models***

Anup Tuladhar [1], Daniel Comadurán Márquez [1], Araz Minhas [1], Adam Kirton [1], Eli Kinney-Lang [1]

[1] University of Calgary

P1-E-65 ***The first BCI clinical trial for stroke neurorehabilitation in Latin America: The ReHand-BCI trial***

Jessica Cantillo-Negrete [1], Martin Emiliano Rodriguez-Garcia [2], Paul Carrillo-Mora [1], Oscar Arias-Carrion [3], Emmanuel Ortega-Robles [3], Marlene Galicia-Alvarado [1], Raquel Valdes-Cristerna [2], Ana Guadalupe Ramirez-Nava [1], Claudia Hernandez-Arenas [1], Jimena Quinzaños-Fresnedo [1], Ma Del Refugio Pacheco-Gallegos [1], Norma Marin-Arriaga [1], Ruben Carino-Escobar [1]

[1] Instituto Nacional de Rehabilitacion, [2] Universidad Autónoma Metropolitana, [3] General Hospital Manuel Gea Gonzalez

P1-F-66 ***Patient-Specific Visual Neglect Severity Estimation for Stroke Patients using an AR and EEG based BCI***

Murat Akcakaya [1], Deniz Kocanaogullari [1], Richard Gall [1], Jennifer Mak [1], Xiaofei Huang [2], Katie Mullen [1], Sarah Ostadabbas [2], George Wittenberg [1], Emily Grattan [1]

[1] University of Pittsburgh, [2] Northeastern University

P1-F-67 ***Comparative Evaluation of Compact and Research-Grade EEG in BCI: P300-Based Visual/ Auditory Oddball Tasks***

Suyeon Yun [1], Sunghan Lee [1], In Cheol Jeong [1]

[1] Hallym University

P1-F-68 ***Unlocking Neural Patterns: A Graph Neural Network Model to Classify and Analyze EEG Connectivity in Parkinson's Disease***

Alessandro Vato [1], Artur Aharonyan [1]

[1] Catholic University of America

P1-F-69 ***Neuromorphic Processing of sEMG Signals for Finger Position Estimation***

Corentin Piozin [1], Hoda Fares [1], Farshad Moradi [1]

[1] Aarhus University

P1-F-70 ***Decoding Text Embeddings From Functional MRI Data Using Deep Learning***

Diogo Schwerz De Lucena [1], Lorenzo Alencar Tomaz [1], Judd Rosenblatt [1]

[1] AE Studio

P1-F-71 ***Fine-Tuning a Foundation Model for Motor Imagery Pediatric Brain-Computer Interfaces (BCIs)***

Mohammadreza Behboodi [1], Eli Kinney-Lang [1], Adam Kirton [1], Hatem Abou-Zeid [1]

[1] University of Calgary

P1-F-72 ***An EEG Artifact Removal Neural Network for BCI Applications with EEG-ViTNet***

Jerry Wan [1]

[1] Holland Bloorview Kids Rehabilitation Hospital

P1-F-73 ***Collaborative Virtual Reality BCI Post-Stroke Neurorehabilitation Using Head-Mounted Displays***

Roman Rosipal [1], Nina Evetovic [1], Zuzana Rostakova [1], Arina Polyanskaya [2], Martin Vankó [1], Stefan Korecko [3], Branislav Sobota [3], Natalia Porubcová [1], Leonard Trejo [4]

[1] Slovak Academy of Sciences, [2] University of Vienna, [3] Technical University of Košice, [4] Pacific Development and Technology, LLC

P1-F-74 ***Asynchronous SSVEP based BCI using ²-stage Deep learning approach***

Heegyu Kim [1], Minkyu Ahn [2], Sung Jun [1]

[1] Gwangju Institute of Science and Technology (GIST), [2] Handong Global University

P1-F-75 ***A Pilot Study for SSVEP-based Person Recognition***

Yute Wang [1], Yu-Lin Chu [2]

[1] Academia Sinica, [2] Research Center for Information Academic Sinica

P1-F-76 ***A P300 Brain-Computer Interface as a Diagnostic Tool for Measuring the Efficacy of Psychotherapeutic Intervention***

Sonja Kleih-Dahms 1, Andrea Kübler [1]

[1] University of Würzburg

P1-F-77 ***Independent Multiuser-Brain Computer Interface (mBCI): A Scoping Review***

Cindy Natalia Molano Camargo [1]

[1] University of Toronto

P1-F-78 ***Jitter and Latency Characterization in Closed-Loop Neuromodulation during NREM Sleep in elderly and pathological population***

Rodrigo Ramele [1], Matías Pretel [1], Aylin Vazquez-Chenlo [1], Lucila Capurro [1], Cecilia Forcato [1]

[1] Instituto Tecnológico de Buenos Aires (ITBA)

P1-F-79 *Development of EEG-Based Optimal Biomarkers for Decoding Mental Fatigue during Motor Imagery Tasks*

Jun-Seok Lee [1], Seung-Won Lee [1], Sang-Rok Kim [1], Won-Seok Kim [2], Jeonghun Ku [3], Han-Jeong Hwang [1]

[1] Korea University, [2] Seoul National University Bundang Hospital, [3] Keimyung University

P1-F-80 *Neurophysiological Understanding of the Effect of White Noise on Working Memory Performance Based on Electroencephalography*

Seung-Won Lee [1], Jun-Seok Lee [1], Han-Jeong Hwang [1]

[1] Korea University

P1-F-81 *A non-invasive brain computer-brain stimulation interface to enhance motor rehabilitation*

Ameer Hamoodi [1], Stevie Foglia [1], Aimee Nelson [1]

[1] McMaster University

P1-G-82 *Subject-Transfer Approach based on Convolutional Neural Networks for Classifying Gait-related Motor Imagery*

Keun-Tae Kim [1]

[1] Hallym University

P1-G-83 *Task-Based Functional Network and Topological Data Analysis of Event Related Potentials in Chronic Tinnitus*

Jihoo Kim [1], Seunghu Kim [1], June Choi [2], Sungkean Kim [1]

[1] Hanyang University, [2] Korea University Ansan Hospital

P1-G-84 *An SSVEP Regression Network for Cross-stimulus Transfer in SSVEP-BCIs*

Ximing Mai [1], Jianjun Meng [1], Xiangyang Zhu [1]

[1] Shanghai Jiao Tong University

P1-G-85 *MultiPy – An open-source Python toolbox for multimodal real-time analysis*

Franziska Klein [1]

[1] OFFIS e.V. Institute for Information Technology

P1-G-86 *Classification of upper extremity function in stroke using magnetic resonance imaging acquired during Brain-computer interface protocols for neurorehabilitation*

Ruben Carino-Escobar [1], Jessica Cantillo-Negrete [1]

[1] Instituto Nacional de Rehabilitacion

P1-G-87 *Wavelet Scattering-based EEG Channel Reduction for Motor Imagery Classification*

Dong Jin Sung [1]

[1] Korea University

P1-G-88 *Decoding Hand Gestures from Gyral and Sulcal Regions of the Sensorimotor Cortex Using High-Resolution fMRI*

Maria Kromm [1], Mathijs Raemaekers [2], Mariana Branco [2], Nick Ramsey [1]

[1] University Medical Center Utrecht, [2] UMC Utrecht Brain Center

P1-G-89 *Do Complex Vision Models Improve Feature Alignment with fMRI for Neural Decoding of Visual Stimuli?*

Marco Finocchiaro [1], Federica Proietto Salanitri [1], Lisa Passarello [1], Concetto Spampinato [1], Salvatore Calcagno [1]

[1] University of Catania

P1-G-90 *Can sex be decoded from MI features in deep learning based BCIs?: An exploratory analysis*

Bruno Zorzet [1], Rodrigo Echeveste [1], Diego H. Milone [1], Victoria Peterson [2]

[1] Instituto de Investigación en Señales, Sistemas e Inteligencia Computacional (sinc(i)), [2] IMAL Instituto de Matemática Aplicada del Litoral

SESSION 2

Wednesday, June 4 4:00pm - 6:00pm

P2-A-01 *Neural encoding and decoding of multidimensional handwriting movement*

Yaoyao Hao [1], Guangxiang Xu [1], Zebin Wang [1], Yueming Wang [1]

[1] Zhejiang University

P2-A-02 *Speech mode classification from electrocorticography signals*

Aurélie De Borman [1], Benjamin Wittevrongel [1], Bob Van Dyck [1], Kato Van Rooy [2], Ine Dauwe [3], Evelien Carrette [2], Alfred Meurs [2], Dirk Van Roost [2], Paul Boon [2], Marc Van Hulle [1]

[1] KU Leuven, [2] Ghent University, [3] Ghent University Hospital

P2-A-03 *Beyond Single Datasets: Transfer Learning for iBCI Decoding*

Emily Mo Nipshagen [1], Julia Berezutskaya [2], Yağmur Güçlütürk [1], Pieter Kubben [3], Marcel Van Gerven [1]

[1] Radboud University, [2] UMC Utrecht Brain Center, [3] Maastricht University Medical Center

P2-A-04 *Bilateral frontotemporal neuronal dynamics during natural conversation: Single-neuron insights for BCI technologies*

Mohsen Jamali [1], Irene Caprara [2], Analise Bottinger [3], Emery Jacobowitz [3], Ziv Williams [1]

[1] Massachusetts General Hospital & Harvard Medical School, [2] Massachusetts General Hospital, [3] Northeastern University

P2-A-05 ***Semantics decoding using human intracranial EEG during natural speech production***

Jing Cai [1], Camille Pescatore [2], Haoyu Zhang [2], Ziv Williams [3], Sydney Cash [2]

[1] Harvard Medical School, [2] Massachusetts General Hospital, [3] Massachusetts General Hospital & Harvard Medical School

P2-A-06 ***BCI Training-Induced Neuroplasticity: Evidence from Long-Term Neural Activity Analysis***

Lucas Struber [1]

[1] Commissariat à l'énergie atomique et aux énergies alternatives

P2-A-07 ***Towards a decision-making BCI for dynamic detection of uninformed decisions***

Sophia Gimple [1]

[1] Maastricht University

P2-A-08 ***BCI-sift: An Automated Feature Selection Toolbox for Brain-Computer Interface Applications***

Elena Offenberg [1], Dirk Keller [1], Mariska Vansteensel [1], Mariana Branco [1], Nick Ramsey [1], Julia Berezutskaya [1]

[1] University Medical Center Utrecht Brain Center3

P2-A-09 ***Quantifying Neuro-motor Relationships using Deep Learning for Deep Brain Stimulation Targeting in Parkinson's Disease***

Erin Radcliffe [1], Daniel Kramer [1], Drew Kern [1], John Thompson [1]

[1] University of Colorado Anschutz Medical Campus

P2-A-10 ***Efficient and accurate cortical spike train decoding for BCI implants with recurrent spiking neural networks***

Tengjun Liu [1], Tuoru Li [1], Julia Gygax [2], Julian Rossbroich [2], Tianyang Li [3], Yuqi Yang [1], Zihao Li [1], Yansong Chua [4], Jie Yang [3], Weidong Chen [1], Friedemann Zenke [2], Shaomin Zhang [1]

[1] Zhejiang University, [2] Friedrich Miescher Institute for Biomedical Research, [3] Westlake University, [4] China Nanhu Academy of Electronics and Information Technology

P2-A-11 ***Development of Brain-Computer Interface Translational Research Platform in Canine Models***

Frederik Lampert [1]

[1] Mayo Clinic

P2-A-12 ***Neural Mechanisms of Dual Motor and Language Processing***

Crispin Foli [1], A. Bolu Ajiboye [1], Emily Conlan [1], William Memberg [1]

[1] Case Western Reserve University

P2-A-13 ***Meta-AlignNN: A Meta-Learning Framework for Stable BCI Performance Across Subjects, Time, and Tasks***

Yongjie Zou [1], Zhenliang He [1], Congcong Zhang [1], Kai Liu [1], Yu Ling [1], Mengyu Li [1], Fei Wang [1], Yulei Chen [1], Mingxin Li [1], Chengyu Li [1]

[1] Lin Gang Laboratory

P2-A-14 ***Phoneme Sequence Encoding in Ventral Motor Cortex***

Chaofei Fan [1], Benyamin Meschede-Krasa [1], Erin Kunz [1], Foram Kamdar [2], Nicholas Card [2], Maitreyee Wairagkar [2], Carrina Iacobacci [2], Leigh Hochberg [3], David Brandman [2], Sergey Stavisky [2], Shaul Druckmann [1], Chris Manning [1], Jaimie Henderson [1], Francis Willett [1]

[1] Stanford University, [2] University of California, Davis, [3] Brown University

P2-A-15 ***Decoding Attempted Speech in an Individual with Locked-in Syndrome***

Julia Berezutskaya [1], Alexandre Spacassassi Silva [2], Simon Geukes [1], Malinda Verberne [1], Anouck Schippers [1], Zac Freudenburg [1], Mariana Branco [1], Erik Aarnoutse [2], Nathan Crone [3], Mariska Vansteensel [1], Nick Ramsey [2]

[1] UMC Utrecht Brain Center, [2] University Medical Center Utrecht, [3] Johns Hopkins University School of Medicine

P2-A-16 ***Extensive, non-uniform neural activation from intracortical electrical stimulation drives weak sensory perception in mice***

Jordan Hickman [1], Daniel Denman [1]

[1] University of Colorado Anschutz Medical Campus

P2-A-17 ***Movement decoding: Dealing with neural signal drift***

Etienne De Montalivet [1], Nima Mojtahedi [1], Iris Maya Toye [2], Shiqi Sun [2], Titouan Brossy [2], Quentin Devaud [2], Charles-François Vincent Latchoumane [2], Jocelyne Bloch [3], Gregoire Courtine [3], Kyuhwa Lee [1]

[1] Wyss Center for Bio and Neuroengineering, [2] École Polytechnique Fédérale de Lausanne, [3] Defitech Center for Interventional Neurotherapies

P2-A-18 ***BrainGPT: Learning the natural language of the human brain to operate neuroprosthesis***

Icare Sakr [1], Henri Lorach [1], Gregoire Courtine [2], Valeria Spagnolo [3], Thibault Collin [4], Felix Martel [5], Tetiana Aksenova [5], Andrea Galvez [4]

[1] École Polytechnique Fédérale de Lausanne, [2] Defitech Center for Interventional Neurotherapies, [3] University of Lausanne, [4] NeuroRestore, [5] Commissariat à l'énergie atomique et aux énergies alternatives

P2-A-19 ***Recalibration of implantable brain-computer interface devices to enable long- term independent use: A systematic review***

Eleanor Swanson [1], Esmee Dohle [2], Luke Bashford [3], Hugo Layard Horsfall [4], Luka Jovanovic [5], Jamie Brannigan [2]

[1] University Medical Center Utrecht, [2] Oxford University Hospital, [3] Newcastle University, [4] National Hospital for Neurology and Neurosurgery, [5] East and North Hertfordshire NHS Trust

P2-A-20 ***Daily independent conversational speech decoding from the intracortical neural activity of a man with ALS***

Nicholas Card [1], Hamza Peracha [1], Tyler Singer-Clark [1], Carrina Iacobacci [1], Maitreyee Wairagkar [1], Xianda Hou [1], Leigh Hochberg [2], David Brandman [1], Sergey Stavisky [1]

[1] University of California, Davis, [2] Brown University

P2-C-21 ***A Transfer Learning Framework for Across-speaker Articulatory Movement Decoding in Sensorimotor Cortex***

Ruoling Wu [1], Julia Berezutskaya [1], Zac Freudenburg [1], Elena Offenberg [1], Nick Ramsey [1]

[1] University Medical Center Utrecht

P2-C-22 ***A sEEG-based BCI for Brain-to-Chinese Language Decoding***

Jie Yang [1], Lu Cao [1], Yifei Jia [1], Di Wu [1], Yue Zhang [1], Mohamad Sawan [1]

[1] Westlake University

P2-C-23 ***Changes in globus pallidus internus local field potentials during freezing-of-gait in Parkinson's disease***

Josephine Wallner [1], Dean Krusienski [1], Harsh Shah [2]

[1] Virginia Commonwealth University, [2] VCU

P2-C-24 ***Identifying Motor-Specific Biomarkers in Parkinson's Disease: A Focus on Neural Activity in the Primary Motor Cortex***

Xiang Shen [1]

[1] Guangdong Institute of Intelligence Science and Technology

P2-C-25 ***A pilot study towards synthesizing speech during intraoperative recordings using the Layer 7 cortical interface***

Miguel Angrick [1], Shiyu Luo [1], Daniel Candrea [1], Rohit Ganji [1], Katrina Barth [2], Jackie Dister [2], Josh Miller [2], Elton Ho [2], Kurt Lehner [1], Youssef Comair [1], Benjamin Rapoport [2], Nathan Crone [3]

[1] Johns Hopkins University, [2] Precision Neuroscience, [3] Johns Hopkins University School of Medicine

P2-C-26 ***Clinical Brain Computer Interface for adaptive neuromodulation in Parkinson's disease as regular clinical care: A protocol***

Martijn De Neeling [1], Bart J. Keulen [1], Mariëlle J. Stam [1], Deborah Hubers [1], Rob M.A. De Bie [1], Bernadette C.M Van Wijk [1], P. Rick Schuurman [1], Maarten Bot [1], Arthur W.G. Buijink [1], Martijn Beudel [1]

[1] Amsterdam University Medical Center

P2-D-28 ***Quantifying the spatial stability of sensory stimulation projected fields for neuroprostheses***

Keqin Ding [1], Mark Iskarous [2], Luke Osborn [3], Breanne Christie [1], Dayann D'almeida [1], Kaichen Yu [1], Matthew Fifer [1], Pablo Celnik [4], Francesco Tenore [1], Brian Caffo [1], Nitish Thakor [1]

[1] Johns Hopkins University, [2] University of Chicago, [3] Case Western University, [4] Shirley Ryan Ability Lab

P2-D-29 ***Comparative Analysis of the NeuroExo, the Stentrode, and the N1 BCI devices***

Jose Contreras-Vidal [1], Zoya Fazal [2]

[1] University of Houston, [2] Universty of Houston

P2-D-30 ***Reporting checklist for observational implanted and non-implanted neural interface studies: Protocol for a Delphi process***

Martijn De Neeling [1], Katharine "Katya" Hill [2], Ricardo Chavarriaga [3], Jane Huggins [4], Luigi Bianchi [5], Armani Porter [6], Mariska Vansteensel [7]

[1] Amsterdam University Medical Center, [2] University of Pittsburgh, [3] Zurich University of Applied Sciences, [4] University of Michigan, [5] Tor Vergata University, [6] Magnus Medical, [7] UMC Utrecht Brain Center

P2-D-31 ***Ear-EEG Auditory Error-Related Potentials***

Allan Frederick [1], Deland Liu [1], Ju-Chun Hsieh [1], Huiliang Wang [1], José Del R. Millán [1]

[1] University of Texas at Austin

P2-D-32 ***Toward EEG discrimination of fingers movements during motor imagery vs passive movement***

Théo Lefeuvre [1]

[1] Centre National de la Recherche Scientifique

P2-D-33 ***Intentional binding in BCI, how time elicits better neurophysiological responses***

Tristan Venot [1], Arthur Desbois [1], Marie-Constance Corsi [1], Laurent Hugueville [2], Ludovic Saint-Bauzel [3], Fabrizio De Vico Fallani [1]

[1] Institut National de Recherche en Informatique et en Automatique, [2] Institut du Cerveau, [3] ISIR Sorbonne Université

P2-D-34 ***Affective-Visual-Voice-Feedback Immersive Brain-Computer Interface Integrating EEG-Based Motor Imagery and Generative AI for Stroke Patients***

Chia-Hsin Chen [1]

[1] Kaohsiug Medical University Hospital

P2-D-35 ***Functional ultrasound neuroimaging through a human cranial window for decoding of movement effector somatotopy in primary motor cortex***

Lydia Lin [1], Thierri Callier [1], Charles Liu [2], Mikhail Shapiro [1], Richard Andersen [1]

[1] California Institute of Technology, [2] University of Southern California

P2-D-36 ***EEG decoding of gait for clinical rehabilitation and assessment***

Neethu Robinson [1], Xi Fu [1], Rui Liu [1], Aung Aung Phyo Wai [1], Leran Jenny Liang [1], Yuting Tang [1], Cuntai Guan [1]

[1] Nanyang Technological University

P2-D-37 ***Optimizing P300 Speller Performance through Uncertainty Quantification***

Andreea Sburlea [1], Ivo De Jong [1], Bernard Renardi [1]

[1] University of Groningen

P2-D-38 ***Motor-imagery neurofeedback for beta downregulation in Parkinson's disease***

Claire Dussard [1], Emeline Pierrieau [2], Déborah Ziri [1], Cassandra Dumas [1], Marie-Laure Welter [3], Laurent Hugueville [4], Brian Lau [1], Camille Jeunet-Kelway [5], Carine Karachi [1], Nathalie GEORGE [6]

[1] Sorbonne Université, [2] Université de Bordeaux, [3] Centre Hospitalier Universitaire Rouen, [4] Institut du Cerveau, [5] University of Bordeaux, [6] Centre National de la Recherche Scientifique

P2-D-39 ***Brain-Computer Gaming Control through Imagined Speech Commands in Single-player***

Alma Rosa Cuevas Romero [1], Luz María Alonso Valerdi [1], Luis Alberto Muñoz Ubando [1], Alejandro Torres-Garcia [2]

[1] Tecnológico de Monterrey, [2] Instituto Nacional de Astrofísica, Óptica y Electrónica

P2-D-41 ***The potential of the 1/f EEG slope at rest for predicting BCI performance: A brain criticality hypothesis for BCI use***

Tomko Settgast [1], Andrea Kübler [1]

[1] University of Würzburg

P2-D-42 ***Adaptive EEG-Based Brain-Computer Interfaces for Stroke Patients: A Scoping Review***

Celeste Cisi [1], Maryam Alimardani [1]

[1] Vrije Universiteit Amsterdam

P2-D-43 ***Bayesian Reinforcement Learning for Optimizing the BCI-Utility of P300 Brain-Computer Interfaces***

Bangyao Zhao [1], Yixin Wang [1], Jane Huggins [1], Jian Kang [1]

[1] University of Michigan

P2-D-44 ***Closed-Loop Augmentation of Cognitive States***

Conor Russomanno [1], Musa Mahmood [1], Alejandro Covalin [2], Navid Khodaparast [2], Jackie Kohl [1], Isaac Plotkin [1], Joseph Artuso [1], Zoe Steine-Hanson [1]

[1] OpenBCI, Inc., [2] Spark Biomedical Inc

P2-D-45 ***EEG-based classification of awareness in disorders of consciousness***

Ana Matran-Fernandez [1], Serafeim Perdikis [1], Rab Nawaz [1], Marina Lopes Da Silva [2], Tommaso Bertoni [3], Jean-Paul Noel [4], Jane Jöhr [3], Andrea Serino [3], Karin Diserens [2], Reinhold Scherer [1], Sebastian Halder [1]

[1] University of Essex, [2] Centre Hospitalier Universitaire Vaudois, [3] University of Lausanne, [4] University of Minnesota

P2-D-46 ***Enriching the Image: Does Combining Motor Imagery with Haptic Input Affect the Event-Related Desynchronization?***

Jennifer Decker [1]

[1] University of Oldenburg

P2-D-47 ***Real-Time Classification and Modulation of the Distractor Positivity with an EEG BCI***

Anastasiia Melnichuk [1]

[1] University of Texas at Austin

P2-D-48 ***Error-Positivity Amplification with Alternating-Current Stimulation Augments Perceptual Skills to Detect Errors***

Deland Liu [1], Holland Ernst [1], Michael Solomon [1], Frigyes Racz [1], Hannah Lee [1], Jose Del R. Millan [1]

[1] University of Texas at Austin

P2-D-49 ***Multimodal Biosensing and Unsupervised Clustering Reveal Neuro- and Physiological Correlates of Emotion***

Maryam Bijanzadeh [1], Bijurika Nandi [1], Richard Campusano [1], Jennifer Townsend [1], Isabella Hartley [1], Adam Gazzaley [1], Theodore Zanto [1], Reza Abbasiasl [1]

[1] University of California, San Francisco

P2-D-50 ***Passive Neuroart BCI for Health: A Perspective***

Marc Welter [1], Tomasz Rutkowski [2], Fabien Lotte [1]

[1] Institut National de Recherche en Informatique et en Automatique, [2] RIKEN Center for Advanced Intelligence Project (AIP)

P2-D-51 *Accuracy Analysis of P300 BCI Famous Face Stimuli*

Francisco Vigil [1]

[1] *University of Michigan*

P2-D-52 *Decoding Imagined Handwriting from single-trial EEG*

Srinivas Ravishankar [1], Virginia De Sa [1]

[1] *University of California, San Diego*

P2-F-53 *Transparent c-VEP-based passive BCI to probe spatial attention*

Pietro Cimarosto [1], Kalou Cabrera Castillos [1]

[1] *Institut Supérieur de l'Aéronautique et de l'Espace*

P2-F-54 *Brain-Computer Interface Communication Application for Children with Diverse Learning Needs*

Beverly Anne Collisson [1], Eli Kinney-Lang [1], Georgie Brewin [2], Brian Irvine [1], Marie-Claire Dylke [2], Adam Kirton [1]

[1] *University of Calgary,* [2] *Calgary Board of Education*

P2-F-55 *Temporally Interfering electrical stimulation reduce interictal epileptiform discharges in rats*

Jiahui Che [1]

[1] *Tianjin University*

P2-F-56 *Preliminary Evaluation of the Safety of Single-Parameter Ultrasound Stimulation on the Visual Cortex in Rats*

Shupeng Tao [1]

[1] *Tianjin University*

P2-F-57 *TMS-based neurofeedback facilitates motor imagery of different hand actions*

Hsiao-Ju Cheng [1], Olivia Hochstrasser [1], Eunice Tai [1], Daryl Chong [1], Nicole Wenderoth [2]

[1] *Singapore-ETH Centre,* [2] *ETH Zürich*

P2-F-58 *A Brain-Computer Interface Approach to Music and Sound Generation*

Luigi Bianchi [1]

[1] *Tor Vergata University*

P2-G-59 *The Application of Stereo-electroencephalography for Brain-computer Interfaces*

Maxime Verwoert [1]

[1] *Maastricht University*

P2-G-60 *Sequential Forward Selection (SFS) for Transfer Learning Source Selection in Motor Imagery BCI*

Brian Irvine [1], Eli Kinney-Lang [1], Adam Kirton [1], Hatem Abou-Zeid [1]

[1] *University of Calgary*

P2-G-61 *Minimal calibration MI-BCIs via inter-subject transfer learning with optimal transport*

Catalina Galván [1], Victoria Peterson [2], Ruben Daniel Spies [1], Diego Humberto Milone [3]

[1] *IMAL Instituto de Matemática Aplicada del Litoral,* [2] *Consejo Nacional de Investigaciones Científicas y Técnicas,* [3] *Instituto de Investigación en Señales, Sistemas e Inteligencia Computacional (sinc(i))*

P2-G-62 *Multimodal Multivariate Granger Causality Between EEG and fNIRS during an Auditory Task*

John McLinden [1], Behtom Adeli [1], Alex Cerullo [1], Ming Shao [2], Kevin Spencer [3], Mascha Van 'T Wout-Frank [4], Yalda Shahriari [1]

[1] *University of Rhode Island,* [2] *University of Massachusetts, Dartmouth,* [3] *VA Boston Healthcare System & Harvard Medical School,* [4] *Brown University*

P2-G-63 *Changes in Brain Oscillatory Dynamics in Elderly Adults as a Consequence of Natural Aging*

Lucila Capurro [1], Michael Radloff [2], Luis Ignacio Brusco [3], Rodrigo Ramele [1], Cecilia Forcato [1]

[1] *Instituto Tecnológico de Buenos Aires (ITBA),* [2] *University of Klagenfurt,* [3] *Consejo Nacional de Investigaciones Científicas y Técnicas*

P2-G-64 *Examining sEEG Traveling Wave Instances During Speech Production and Auditory Perceptual Contexts*

Michael Dexheimer [1], Pedram Zanganeh Soroush [1], Harsh Shah [1], Jerry Shih [2], Paul Koch [1], Dean Krusienski [1]

[1] *Virginia Commonwealth University,* [2] *University of California, San Diego*

P2-G-65 *Optimizing Imagined Speech Decoders: A Comprehensive Study on Intra-Subject Classification*

Jenny Muñoz-Montes De Oca [1], Alejandro Torres-Garcia [1], Carlos Alberto Reyes-García [1], Luis Villaseñor-Pineda [1]

[1] *Instituto Nacional de Astrofísica, Óptica y Electrónica*

P2-G-66 *Multimodal Sensor Fusion for EEG-Based BCI Typing Systems*

Basak Celik [1], Tab Memmott [2], Georgios Stratis [1], Matthew Lawhead [2], Betts Peters [2], Daniel Klee [2], Melanie Fried-Oken [2], Deniz Erdogmus [1]

[1] *Northeastern University,* [2] *Oregon Health and Sciences University (OHSU)*

P2-G-67 *Evaluation of spatial and frequency features for improving the classification of motor imagery*

Eduardo Perez-Hernandez [1], José Fco. Martínez-Trinidad [1]

[1] *Instituto Nacional de Astrofísica, Óptica y Electrónica*

P2-G-68 ***Population Transformer: Learning Population-level Representations of Neural Activity***

Geeling Chau [1], Christopher Wang [2], Sabera Talukder [1], Vighnesh Subramaniam [2], Saraswati Soedarmadji [1], Yisong Yue [1], Boris Katz [2], Andrei Barbu [2]

[1] California Institute of Technology, [2] Massachusetts Institute of Technology

P2-G-69 ***ezmsg: An Enhanced Open-Source Framework for High-Performance Brain-Computer Interface Development***

Chadwick Boulay [1], Griffin Milsap [2], Preston Peranich [2], Sarah Aswegan [1], Janir Ramos Da Cruz [3], Joachim Dunant [3], David Ibanez Soria [3], Spencer Kellis [1], Robert Franklin [1]

[1] Blackrock Neurotech, [2] Johns Hopkins University, [3] Wyss Center for Bio and Neuroengineering

P2-G-70 ***Distinguishing foveal and peripheral vision from brain activity using fNIRS***

Manuel Ramírez-Cruz [1], Carlos Alberto Reyes-García [1], Anabel Socorro Sanchez-Sanchez [1]

[1] Instituto Nacional de Astrofísica, Óptica y Electrónica

P2-G-71 ***Parametric control of neurons in IT cortex as a stringent generalization test for deep encoding models***

Jacob Prince [1], Binxu Wang [1], Akshay V. Jagadeesh [2], Thomas Fel [1], Emily Lo [1], George A. Alvarez [1], Margaret S. Livingstone [2], Talia Konkle [1]

[1] Harvard University, [2] Harvard Medical School

P2-G-72 ***Brain-Informed Auditory Scene Understanding: A Listener-Aware Auditory Foundation Model for Personalized Speech Processing***

Xilin Jiang [1], Sukru Samet Dindar [1], Vishal Choudhari [1], Stephan Bickel [2], Ashesh D. Mehta [2], Catherine Schevon [1], Guy M. Mckhann [1], Adeen Flinker [3], Daniel Friedman [3], Nima Mesgarani [1]

[1] Columbia University, [2] Northwell Health, [3] New York University School of Medicine

P2-G-73 ***Zero-shot Deep Learning for Calibration-free Motor Imagery BCIs***

Berat Aras [1], Maryam Alimardani [1]

[1] Vrije Universiteit Amsterdam

P2-H-75 ***Enhancing Online Learning through Neuroadaptive Interfaces: The Role of Motivation and Task Load Adaptation***

Katrina Sollazzo [1], Alexander John Karran [1], Thaddé Rolon-Merette [1], Ioana Mihaela Stefanescu [1], Pierre-Majorique Léger [1], Constantinos Coursaris [1], Sylvain Sénécal [1]

[1] HEC Montréal

P2-H-76 ***EEG-Based Brain-Computer Interface for a Tetraplegic Individual Using Motor Imagery for Cybathlon ²024***

Isabel Tscherniak [1], Iustin Curcean [1], Leon Jokinen [2], Sadat Hodzic [2], Thomas Huber [1], Daniel Pavlov [1], Manuel Methasani [1], Ana Mcwhinnie-Fernández [1], Thien Le [1], Niels Christopher Thiemann [1], Flaminia Pallotti [1], Lucas Mateus Castro [1], Enrico Fazzi [1], Levi Frim [1], Delfina Luisa Taskin Espinoza [1]

[1] Technical University Munich, [2] Ludwig Maximilian University of Munich

P2-H-77 ***TALES – Tech, Analysis, Legal, Ethics, Social: A Comprehensive Impact Assessment Framework for Responsible Neurotech Innovation***

Jonathan Coutinho [1], Pauline Gaprielian [1], Susan Boehnke [1]

[1] Queen's University

P2-H-78 ***The History and Future of (Re) Defining BCIs***

Brendan Allison [1], Gerwin Schalk [2]

[1] University of California, San Diego, [2] Tianqiao and Chrissy Chen Institute

P2-H-79 ***Gathering Clinicians' Perspectives for an Initial Design for Hybrid BCI Wheelchair Control***

Maria Insuasty Pineda [1], Lesley Pritchard [1], John Andersen [2], Leah Hammond [3], Kim Adams [1]

[1] University of Alberta, [2] University of Alberta & Glenrose Rehabilitation Hospital, [3] Glenrose Rehabilitation Hospital

P2-H-80 ***Impact of Surrounding Audio-Visual Complexity on Symptomatology of Laryngeal Dystonia: A Virtual Reality Study***

Jimmy Petit [1], Stefan Ehrlich [1], Garrett Tougas [2], Jacob Bernstein [2], Nicole Buie [2], Kristina Simonyan [1]

[1] Harvard Medical School, [2] Mass Eye and Ear

P2-H-81 ***Understanding Patient Preferences for Implantable Brain–Computer Interfaces in Motor Neuron Disease: A Cross-Sectional Survey***

Jamie Brannigan [1], Hugo Layard Horsfall [2], Richard Cave [3], Luke Bashford [4], William Muirhead [3]

[1] Oxford University Hospital, [2] National Hospital for Neurology and Neurosurgery, [3] University College London, [4] Newcastle University

P2-H-82 ***Building ethics into next-generation BCI: A model for embedded ethics in neurotechnology industry***

Juhi Farooqui [1], Landan Mintch [2], Jon Nelson [2], Jacob Robinson [2], Anna Wexler [1]

[1] University of Pennsylvania, [2] Motif Neurotech

P2-H-83 *Easy on the Eyes: Pediatric SSVEP-Based BCI Comfort and Neural Response to Textured Visual Stimuli*

Emily Schrag [1], Daniel Comadurán Márquez [1], Adam Kirton [1], Eli Kinney-Lang [1]

[1] *University of Calgary*

P2-H-84 *Neuroethical considerations on Brain Computer Interface research in Latin America*

Adriana Pliego [1], Hernán Villota [2]

[1] *Autonomous University of Mexico State,* [2] *Institución Universitaria de Envigado*

P2-H-85 *Autonomic Activation, Mental Effort, and Fatigue While Using Non-Implantable RSVP and Matrix cBCIs*

Daniel Klee [1], Tab Memmott [2], Barry Oken [1]

[1] *Oregon Health & Science University,* [2] *Oregon Health and Sciences University (OHSU)*

P2-H-86 *Cognitive requirements for effective brain-computer interface (BCI) use in children with cerebral palsy.*

Johana Rios Ortegon [1], Ada W. S. Leung [1], Kim Adams [1]

[1] *University of Alberta*

P2-H-87 *Brain-Computer Interface (BCI) in Latin America: A scientometrics perspective*

Hernán Villota [1], Jaime Riascos [2]

[1] *Institución Universitaria de Envigado,* [2] *University of Potsdam*

P2-H-88 *Fostering Ethical Neurotechnology Leadership: Preparing BCI Innovators Through Education*

Mary Mcintosh [1], Susan Boehnke [2]

[1] *Dalhousie Medical School,* [2] *Queen's University*

P2-H-89 *Clinical Evaluation of Communication Brain Computer Interfaces in Amyotrophic Lateral Sclerosis: A Landscape Analysis*

Shana Melby [1], Jaganth Nivas Asok Kumar [1], David Mcmullen [2], Spencer Kellis [1]

[1] *Blackrock Neurotech,* [2] *Food and Drug Administration (FDA)*

P2-H-90 *Feasibility of Non-Invasive EEG Brain-Computer Interfaces in Neurologic Music Therapy for Attention Training in Children with Neuromotor Disorders*

Si Long Jenny Tou [1], Susannah Van Damme [1], Andrea Lamont [1], Eunice Kang [1], Tom Chau [2]

[1] *Holland Bloorview Kids Rehabilitation Hospital,* [2] *Holland Bloorview Kids Rehabilitation Hospital & University of Toronto*

SESSION 3

Thursday, June 5 3:45pm - 5:45pm

P3-A-01 *Long-term stability and performance of stimulation and recording in a human participant over 2,800 days*

David Bjånes [1], Sean Darcy [1], Luke Bashford [2], Kelsie Pejsa [1], Brian Lee [3], Charles Liu [3], Richard Andersen [1]

[1] *California Institute of Technology,* [2] *Newcastle University,* [3] *University of Southern California*

P3-A-02 *A multifunctional speech and movement intracortical brain-computer interface for communication*

Samuel Nason-Tomaszewski [1], Yunnuo Zhang [2], Anna Pritchard [3], Brandon Jacques [3], Yahia Ali [3], Mattia Rigotti-Thompson [3], Payton Bechefsky [1], Leigh Hochberg [4], Nicholas Au Yong [3], Chethan Pandarinath [3]

[1] *Coulter Department of Biomedical Engineering, Emory University and Georgia Tech, Atlanta, GA, USA,* [2] *Georgia Institute of Technology,* [3] *Emory University & Georgia Institute of Technology,* [4] *Brown University*

P3-A-03 *Decoding gestures from intracortical neural activity in ventral precentral gyrus*

Elizaveta Okorokova [1], Tyler Singer-Clark [1], Nicholas Card [1], Carrina Iacobacci [1], Hamza Peracha [1], Leigh Hochberg [2], David Brandman [1], Sergey Stavisky [1]

[1] *University of California, Davis,* [2] *Brown University*

P3-A-05 *Combatting percept adaptation to intracortical microstimulation in humans*

Taylor Hobbs [1], Charles Greenspon [2], Michael Boninger [1], Robert Gaunt [1]

[1] *University of Pittsburgh,* [2] *University of Chicago*

P3-A-04 *A stabilization approach to improve decoding performance using non-linear dynamical models*

Chiara Ciucci [1], Matteo Pizzinga [1], Diana Carducci [2], Silvestro Micera [1], Eleonora Russo [1]

[1] *Scuola Superiore Sant'Anna,* [2] *University of Pisa*

P3-A-06 *Evoking Facial Expressions by Functional Electrical Stimulation in Healthy Volunteers*

Malinda Verberne [1], Nourdin Chadly [1], Nick Ramsey [2], Mariska Vansteensel [1], Julia Berezutskaya [1]

[1] *UMC Utrecht Brain Center,* [2] *University Medical Center Utrecht*

P3-A-07 *Development of a Novel Clinical Outcome Assessment: The Digital Instrumental Activities of Daily Living Scale*

Abbey Sawyer [1], Jamie Brannigan [2], Lisa Spielman [1], David Putrino [1], Adam Fry [3]

[1] Icahn School of Medicine at Mount Sinai, [2] Oxford University Hospital, [3] Synchron

P3-A-08 *The neural representation of fine hand movements in an individual approaching locked-in syndrome*

Simon Geukes [1], Annike Bekius [2], Mariana Branco [1], Malinda Verberne [1], Anouck Schippers [1], Zac Freudenburg [1], Erik Aarnoutse [2], Mariska Vansteensel [1], Nathan Crone [3], Nick Ramsey [2]

[1] UMC Utrecht Brain Center, [2] University Medical Center Utrecht, [3] Johns Hopkins University School of Medicine

P3-A-09 *Spatio-temporal Comparison of Neural Activity between Prompted and Spontaneous Speech Tasks*

Darius Ivucic [1], Dean Krusienski [2]

[1] University of Bremen, [2] Virginia Commonwealth University

P3-A-10 *Measuring motor intent for BCI control – a comparative analysis of the Stentrode and scalp EEG*

Nikole Chetty [1], James Bennett [2], Ariel Feldman [1], Kriti Kacker [1], Peter Yoo [3], Nicholas Opie [2], David Lacomis [4], Jennifer Collinger [4], Thomas Oxley [3], David Putrino [5], Douglas Weber [1]

[1] Carnegie Mellon University, [2] University of Melbourne, [3] Synchron, [4] University of Pittsburgh, [5] Icahn School of Medicine at Mount Sinai

P3-A-11 *Detailed Somatotopy of Speech Articulators in the Somatosensory Cortex to Define Electrocortical Stimulation Location*

Annike Bekius [1], Maria Kromm [1], Mathijs Raemaekers [2], Erik Aarnoutse [1], Fabiola De Andrade [1], Sifra Blok [1], Malinda Verberne [2], Nick Ramsey [1], Mariska Vansteensel [2]

[1] University Medical Center Utrecht, [2] UMC Utrecht Brain Center

P3-A-12 *Temporal Dynamics of Neural Activation and Inhibition Patterns During Motor Imagery*

Zhichun Fu [1], Xiaolong Wu [1], Zehan Wu [2], Liang Chen [2], Dingguo Zhang [1]

[1] University of Bath, [2] Huashan Hospital

P3-A-13 *Large-scale fMRI dataset for the design of motor-based Brain-Computer Interfaces*

Erik Aarnoutse [1], Magnus Bom [2], Annette Brak [3], Mathijs Raemaekers [2], Nick Ramsey [1], Mariska Vansteensel [2], Mariana Branco [2]

[1] University Medical Center Utrecht, [2] UMC Utrecht Brain Center, [3] University of Amsterdam

P3-A-14 *Recent Improvements of the Wireless Link of the CorTec Brain Interchange Implanted BCI*

Martin Schuettler [1]

[1] CorTec GmbH

P3-A-15 *Neural Dynamics of Cognitive Tasks in Human Prefrontal and Parietal Cortex*

Luke Bashford [1], David Bjånes [2], Jakub Kowalczyk [1], Daniel Kramer [3], Richard Andersen [2]

[1] Newcastle University, [2] California Institute of Technology, [3] University of Colorado Anschutz Medical Campus

P3-A-16 *Neural activity during persistent sensations caused by intracortical microstimulation*

Robin Lienkämper [1], Taylor Hobbs [1], Jorge Gonzalez-Martinez [2], Michael Boninger [1], Jennifer Collinger [1], Robert Gaunt [1]

[1] University of Pittsburgh, [2] University of Pittsburgh Medical Center

P3-A-17 *Versatile Modular Research Platform for Brain-Wide Neuroscience in Navigating Non-Human Primates*

Jiapeng Yin [1], Bin Zhao [1], Guoliang Yi [1], Haonan Niu [1], Mengchuanzhi Yang [1], Xiliang Guo [1], Qiangpei Fu [1], Dan Li [1], Jie Sun [1], Xiaoxing Zhang [1], Peiyuan Li [1], Hao Li [1], Ming Tian [1], Zhihua Li [1], Ji Mu [1], Han Yang [1], Wei Wang [1], Yu Zhou [1], Shibin Wei [1], Yifan Huang [1], Zhicheng Shi [1], Guang Xiong [1], Hongxiong Jiang [1], Yafei Cui [1], Qing Xu [1], Xuqian Shi [1], Yang Xie [1], Chengyu Li [1]

[1] Lin Gang Laboratory

P3-A-18 *Finding the Groove in Neural Space*

Rashi Bhatt [1], John Downey [2], Hugo Merchant [3], Charles Greenspon [2]

[1] Emory University & Georgia Institute of Technology, [2] University of Chicago, [3] Instituto de Neurobiologia UNAM

P3-A-19 *Predicting iBCI efficacy with structural and functional MRI*

Mathijs Raemaekers [1], Simon Geukes [1], Erik Aarnoutse [2], Mariana Branco [1], Zac Freudenburg [1], Anouck Schippers [1], Malinda Verberne [1], Nathan Crone [3], Sacha Leinders [2], Julia Berezutskaya [1], Nick Ramsey [2], Mariska Vansteensel [1]

[1] UMC Utrecht Brain Center, [2] University Medical Center Utrecht, [3] Johns Hopkins University School of Medicine

P3-B-20 *Speech decoding performance is influenced by perceiving auditory feedback or not: Implications for locked-in individuals*

Anouck Schippers [1], Julia Berezutskaya [1], Zac Freudenburg [1], Erik Aarnoutse [2], Mathijs Raemaekers [1], Mariska Vansteensel [1], Nick Ramsey [2]

[1] UMC Utrecht Brain Center, [2] University Medical Center Utrecht

P3-B-21 ***Brain-Spine Interface Stabilizes Hemodynamics after Spinal Cord Injury***

Julien Rimok [1], Donovan Smith [1], Pierre-Olivier Gauthier [2], Ryan Miller [1], Marcus Tso [1], Jan Elaine Soriano [1], Aaron Phillips [1]

[1] University of Calgary, [2] Université de Montréal

P3-B-22 ***Redwood: A user-friendly extension to the BCPy2000 system for developing advanced BCI Applications***

Zac Freudenburg [1], Erik Aarnoutse [2], Erdi Erdal [1], Elena Offenberg [1], Julia Berezutskaya [1], Mariska Vansteensel [1], Nick Ramsey [2]

[1] UMC Utrecht Brain Center, [2] University Medical Center Utrecht

P3-B-23 ***Closed-loop applications for deep brain stimulation and code-modulated visual evoked potentials on Dareplane***

Matthias Dold [1], Joana Pereira [2], Bastian Sajonz [3], Volker Arnd Coenen [3], Jordy Thielen [1], Mark L.F. Janssen [4], Michael Tangermann [1]

[1] Radboud University, [2] University Medical Center of Freiburg University, [3] University Medical Center of Freiburg, [4] Maastricht University Medical Center

P3-B-24 ***An implantable brain-spine interface restoring lower limb movements in a patient with motor complete spinal cord injury***

Valeria Spagnolo [1]

[1] University of Lausanne

P3-B-25 ***Intraoperative detection and classification of speech neural signals using the Layer 7 Cortical Interface***

Shiyu Luo [1], Miguel Angrick [1], Kurt Lehner [1], Katrina Barth [2], Jackie Dister [2], Josh Miller [2], Daniel Candrea [1], Rohit Ganji [1], Elton Ho [2], Benjamin Rapoport [2], Youssef Comair [1], Nathan Crone [3]

[1] Johns Hopkins University, [2] Precision Neuroscience, [3] Johns Hopkins University School of Medicine

P3-B-26 ***A Speech Neuroprosthesis for Decoding High Frequency Activity in Anterior Cingulate and Orbitofrontal Cortices and Hippocampus for Phonemes Articulation***

Ariel Tankus [1], Einat Stern [2], Guy Klein [3], Nufar Kaptzon [3], Lilac Nash [3], Tal Marziano [3], Omer Shamia [3], Guy Gurevitch [1], Lottem Bergman [1], Lilach Goldstein [1], Firas Fahoum [1], Ido Strauss [1]

[1] Tel Aviv Sourasky Medical Center, [2] Tel Aviv Medical Center, [3] Tel Aviv University

P3-B-27 ***Optimizing Decoder Dynamics Strength for Closed-Loop Brain-Computer Interfaces***

Joseph Costello [1], Luis Cubillos [1], Parag Patil [1], Cynthia Chestek [2], Matthew Willsey [1]

[1] University of Michigan, [2] University of Michigan, Ann Arbor

P3-B-28 ***Stereo-EEG Based Brain Computer Interfacing Across a Large Patient Cohort***

Michael Jensen [1]

[1] Mayo Clinic

P3-B-29 ***Towards Calibration-Free ECoG-Based Brain-Computer Interfaces: A Dual-Alignment Incremental Approach***

Maria Justino [1], Felix Martel [1], Henri Lorach [2], Guillaume Charvet [3], Tetiana Aksenova [4]

[1] Commissariat à l'énergie atomique et aux énergies alternatives, [2] École Polytechnique Fédérale de Lausanne, [3] Université Grenoble Alpes, [4] Commissariat à l'Énergie Atomique et aux Énergies Alternatives

P3-B-30 ***Using a Long Short-Term Memory Neural Network for Generation of Control Signals from μECoG Data***

Sankardas Kariparambil Sudheesh [1], Bradley Greger [1]

[1] Arizona State University

P3-B-31 ***Multi-gesture BCI control of a communication board***

Daniel Candrea [1], Shiyu Luo [1], Miguel Angrick [1], Rohit Ganji [1], Griffin Milsap [1], Matthew Fifer [1], Nick Ramsey [2], Nathan Crone [3]

[1] Johns Hopkins University, [2] University Medical Center Utrecht, [3] Johns Hopkins University School of Medicine

P3-B-32 ***Robotic Exploratory Control Via Subcortical Oscillations***

Ian Jackson [1], Raunit Kohli [1], Rhiannon Lucero-Moore [1], Laleh Quinn [1], Leo Breston [1], Janet Wiles [2], Andrea Chiba [1], Eric Leonardis [1]

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P3-B-33 ***Improving Speech Perception Through Brain-Driven Target Speech Selection***

Vishal Choudhari [1], Maximilian Nentwich [2], Sarah Johnson [2], Stephan Bickel [2], Ashesh D. Mehta [2], Adeen Flinker [3], Daniel Friedman [3], Edward Chang [4], Nima Mesgarani [1]

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P3-B-34 ***Towards the Clinical Translation of Implantable Brain-Computer Interfaces for Motor Impairment: Research Trends and Outcome Measures***

Esmee Dohle [1], Eleanor Swanson [2], Luka Jovanovic [3], Suraya Yusuf [4], Lucy Thompson [5], Hugo Layard Horsfall [6], William R Muirhead [6], Luke Bashford [7], Jamie Brannigan [1]

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P3-B-35 *NAVSync: A Real-Time Neural Audiovisual Synchronization Platform for Silent Speech Research*

Qinwan Rabbani [1], Samyak Shah [2], Rohit Ganji [3], Matthew Fifer [3], Laureano Moro-Velazquez [3], Nathan Crone [2]

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P3-B-36 *Should BCIs shape experiences of communication of people with LIS, and if so, how?*

P3-D-37 *Star-Burst paradigm: Implementation of an "invisible" dry-EEG reactive BCI*

Jules Gomel [1], Frédéric Dehais [1], Pietro Cimarosto [1], Kalou Cabrera Castillos [1], Juan Jesus Torre Tresols [1]

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P3-D-38 *The variability of EEG spectral measures in MCS: Towards a multidimensional characterization of the awareness fluctuations*

Ilaria Quattrociocchi [1], Angela Riccio [2], Valentina Caracci [1], Valentina Galiotta [2], Mariagrazia D'ippolito [2], Emanuela Rotondo [1], Floriana Pichiorri [2], Febo Cincotti [1], Jlenia Toppi [1], Donatella Mattia [2]

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P3-D-39 *Decoding of Directional Auditory Attention Shifts in Multi-Talker Environments Using EEG Alpha Power*

Gabriel Ivucic [1]

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P3-D-40 *Deep learning-based electroencephalic decoding of coherence and direction of the random dot kinematogram*

Jaewon Yang [1], Sangbin Yun [1], Byoung-Kyong Min [1]

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P3-D-41 *Ambiguous Text Input for Brain-Computer Interfaces*

Chirag Panchakshari [1], Betts Peters [2], Mackenzie Miller [1], Dylan Gaines [1]

[1] Michigan Technological University, [2] Oregon Health and Sciences University (OHSU)

P3-D-42 *A Novel Rhythmic Motor Imagery BCI with High Efficiency*

Yuxuan Wei [1], Jianjun Meng [1]

[1] Shanghai Jiao Tong University

P3-D-43 *Autoregressive model for artifact detection in finger motor imagery decoding for EEG BCI*

Laura Damm [1]

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P3-D-44 *Investigation of neurobiological and neurophysiological characteristics of migraine patients during a trigger avoidance task before and after a neurofeedback intervention*

Sebastian Evers [1]

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P3-D-45 *Automatic EEG Channel Optimization Based on Integrated Gradients for Auditory Attention Tasks*

Xue Yuan [1], Kenren Shi [1], Hanbin Wang [2], Ning Jiang [1], Jiayuan He [1]

[1] Sichuan University, [2] China Academy of Engineering Physics

P3-D-46 *Exploring Early Predictability of Grasping Movements with non-invasive EEG*

Elena Fenoglio [1]

[1] Italian Institute of Technology

P3-D-47 *Defining Out-of-Distribution detection for EEG-BCIs*

Ivo De Jong [1], Matias Valdenegro-Toro [1], Andreea Sburlea [1]

[1] University of Groningen

P3-D-48 *Addressing the Non-stationary Learning Problem with Graph Attention Networks in Motor Imagery*

Rishan Patel [1], Tom Carlson [1], Dai Jiang [1], Andreas Demosthenous [1], Barney Bryson [1]

[1] University College London

P3-D-49 *Virtual Reality-Based Investigation of Error-Related Potentials in ADHD for BCI applications*

Andreea Sburlea [1], Niclas Brand [2], Theodor Nowicki [1], Stefanie Enriquez-Geppert [1]

[1] University of Groningen, [2] Technical University Munich

P3-D-50 *Predicting V1 spiking activity from scalp EEG in macaques*

Dixit Sharma [1], Bart Krekelberg [1]

[1] Rutgers University Newark

P3-D-51 *Hardware Friendly Corticomorphic Hybrid CNN-SNN Architecture for EEG-Based Auditory Attention Detection*

Richard Gall [1], Deniz Kocanaogullari [1], Murat Akcakaya [1], Deniz Erdogmus [2], Rajkumar Kubendran [1]

[1] University of Pittsburgh, [2] Northeastern University

P3-D-52 *MindVoice: A Multimodal Framework for EEG-Based Speech Decoding*

Anarghya Das [1]

[1] University at Buffalo

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Nicolas Ivanov [1], Tom Chau [1]

[1] University of Toronto

P3-D-54 ***Improving P300 BCI Performance with OSCAR***

Johannes Gruenwald [1]

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P3-D-55 ***Manifold-Based Diffusion Models for Generating Synthetic Motor Imagery EEG***

Imad Eddine Tibermacine [1], Christian Napoli [1]

[1] Sapienza University of Rome

P3-D-56 ***Riemannian-Based Convolutional Neural Networks for EEG Classification***

Imad Eddine Tibermacine [1], Christian Napoli [1]

[1] Sapienza University of Rome

P3-D-58 ***Blink Artifacts in EEG For Classifying Sight-read Music***

Abhinav Uppal [1], Dillan Cellier [1], Sean Bauersfeld [1], Shihab Shamma [2], Gert Cauwenberghs [1], Virginia De Sa [1]

[1] University of California, San Diego, [2] University of Maryland, College Park

P3-D-59 ***Benchmarking one-class Riemannian EEG classifiers to detect wakefulness under general anesthesia***

Valerie Marissens Cueva [1], Sébastien Rimbert [1], Ana Maria Cebolla Alvarez [2], Guy Cheron [2], Claude Meistelman [3], Seyed Javad Bidgoli [4], Fabien Lotte [1], Laurent Bougrain [5]

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P3-D-60 ***Enhanced SSVEP Classification with Pre-trained Models: The SSVEP-CAT Approach for Calibration-Free BCI***

Sara Houshmand [1], Uchechi Ukaegbu [1], Leah Hammond [2], Kim Adams [1], John Andersen [1], Hossein Rouhani [1]

[1] University of Alberta, [2] Glenrose Rehabilitation Hospital

P3-D-61 ***Motor imagery and execution activate similar finger representations that are spatially consistent over time***

Ingrid Odermatt [1]

[1] ETH Zürich

P3-D-62 ***Riemannian Tangent Alignment Enhances BCI Decoding Across Subjects, Sessions, and Modalities***

Seidi Yamauti [1], Gabriel Vasilievic [2]

[1] Federal University of São Paulo, [2] Santos Dumont Institute

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Kiran Nair [1], Hubert Cecotti [1]

[1] California State University, Fresno

P3-D-64 ***Observed Changes in the Visual Odd ball Event-Related Potential in a 10-Session, Longitudinal Study***

Sherif Elbasiouny [1], Justin Estepp [2], Samantha Klosterman [3], Alyssa Stovall [3], Kevin Alexander [4]

[1] Wright State University, [2] Air Force Research Laboratory, [3] BAE Systems, Inc., [4] Oak Ridge Institute for Science and Education

P3-D-65 ***Exploring the Potential of Motor Imagery-Based BCIs for Targeted Motor Function Recovery***

Mona Hejazi [1]

[1] Memorial University of Newfoundland

P3-E-66 ***Bimanual BCI: Combining a Brain-Controlled Hand Exoskeleton with the Functional Limb***

Satyam Kumar [1], Kanishka Mitra [2], Ruofan Liu [1], Hussein Alawieh [1], Akhil Surapaneni [1], Ashish Deshpande [3], José Del R. Millán [1]

[1] University of Texas at Austin, [2] Massachusettes Institue of Technology, [3] Universiy of Texas

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Christine Horner [1], Ledycnarf Holanda [2], Tom Chau [1]

[1] University of Toronto, [2] Holland Bloorview Kids Rehabilitation Hospital

P3-E-68 ***Movement-based navigation of a matrix-speller via EEG***

Markus Crell [1], Kyriaki Kostoglou [1], Gernot Müller-Putz [1]

[1] Graz University of Technology

P3-E-69 ***Toward Commercialization of a High-Efficiency AAC System with BCI Access for Individuals with Minimal Movement***

Jane Huggins [1], Shawn Malcomson [2], Joseph Zolyak [2], Mark Wall [2], Michael O'leary [3], Christina Ferguson [3], Amber Lieto [3], Katherine Colleran [1], Katharine "Katya" Hill [3]

[1] University of Michigan, [2] PRC-Saltillo, [3] University of Pittsburgh

P3-E-70 ***A BCI Robotic Glove System for Hand Motor Rehabilitation***

Shuailei Zhang [1], Neethu Robinson [1], Kavitha Perumpadappil Thomas [1], Yuting Tang [1], Han Wei Ng [1], Aung Aung Phyo Wai [1], Nishka Khendry [1], Christopher Wee Keong Kuah [2], Seng Kwee Wee [2], Karen Sui Geok Chua [2], Cuntai Guan [1]

[1] Nanyang Technological University, [2] Tan Tock Seng Hospital's Rehabilitation Centre

P3-E-71 ***Implementing a Wearable BCI with Patients with Disorders of Consciousness: An Inter-professional Approach***

Katharine "Katya" Hill [1], Amy Wagner [2], Amber Lieto [1], Sarah Baker [2], Amy Bauer [2], Gary Galang [2], Kevin Franzese [2], Siulam Koo [2], Arthur Yan [2], Vishruth Reddy [1], Nabela Enam [3], Evelyn Mariperisen-Meinert [1], Evelyn Mariperisena-Meinert [1]

[1] University of Pittsburgh, [2] University of Pittsburgh Medical Center, [3] University of Pennsylvania

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Boyla Mainsah [1], Leslie Collins [1], Riki Shimizu [1]

[1] Duke University

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Corinne Tuck [1], John Anderson [2], Hosein Bahari [3], Jonathan Wolpaw [4], Jonathan Carp [5], Theresa Vaughan [6]

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P3-E-74 ***The MouthPad^: A high bandwidth wearable intra-oral computer interface***

Suraj Gowda [1], Fernando Del Campo [1], Julian Castellon [1], Randy Castellon [1], Corbin Halliwill [1], Jana Hemsing [1], Virgie Hoban [1], Lily Li [1], Shin Dawn Lo [1], Brian Loh [1], Gabi Munoz [1], Jose Pozuelo [1], Oscar Rosello [1], Corten Singer [1], Tomas Vega [1]

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P3-E-75 ***From Physical to Virtual: Expanding Boccia Accessibility through Patient Partner Engagement***

Daniella Bourque [1], Anup Tuladhar [1], Emily Schrag [1], Nicole Romanow [1], Dejana Nikitovic [2], Alicia Hilderley [1], Eli Kinney-Lang [1], Adam Kirton [1], Daniel Comadurán Márquez [1]

[1] University of Calgary, [2] University of Alberta & University of Calgary

P3-E-76 ***The AppleCatcher Game: A Novel Motor Imagery BCI for Hand Rehabilitation***

Erlend Skredsvig [1]

[1] Norwegian University of Science and Technology

P3-E-77 ***Improving validation of BCI-based CV assessment***

Sebastian Rueda Parra [1], Penelope Norton [1], Darren Gemoets [1], James Norton [2]

[1] National Center for Adaptive Neurotechnologies (NCAN), [2] Samuel Stratton VA Medical Center

P3-E-78 ***Design of a Sensor System for a Semi-Autonomous BCI Controlled Mobility Device***

Morgan Kerr Mcnutt [1], Aleksander Berezowski [1], Liam Workman [1], Haden Scheirman [1], Danielle Jourdain [1], Philippa Madill [1], Adam Kirton [1], Eli Kinney-Lang [1]

[1] University of Calgary

P3-H-79 ***An Evoked Potential of Vection using Passive Brain-Computer Interfaces***

Gael Van Der Lee [1], Anatole Lécuyer [2], François Cabestaing [1], Reinhold Scherer [3], Hakim Si-Mohammed [4]

[1] Université de Lille, [2] Institut National de Recherche en Informatique et en Automatique, [3] University of Essex, [4] University of Lille

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Adam Kirton [1], Danette Rowley [2], Dion Kelly [1], Zeanna Jadavji [1], Ephrem Zewdie [1], Alison Barnfather [3], Amy Wieler [3], Nicole Romanow [1], Erica Floreani [1], Ion Robu [3], Joanna Keough [1], Brian Irvine [1], Araz Minhas [1], Vella Shin-Hyung Kim [1], Daniel Comadurán Márquez [1], Eli Kinney-Lang [1]

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P3-H-82 ***From Research to Reality: Advancing Pediatric BCI Innovations into Clinical Practice***

Danette Rowley [1], Alison Barnfather [2], Amy Wieler [2], Jennifer Murphy [2], Ion Robu [2], Daniel Comadurán Márquez [3], Eli Kinney-Lang [3], Nicole Romanow [3], Adam Kirton [3]

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P3-H-83 ***A Wearable BCI Mediated Generative AI System for Conversational Interactions***

Christopher Ullrich [1]

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P3-H-84 ***BCI-FIT: Effects of cBCI customization on performance***

Betts Peters [1], Michelle Kinsella [1], Daniel Klee [1], Matthew Lawhead [1], Tab Memmott [1], Scott Spaulding [2], Barry Oken [2], Melanie Fried-Oken [1]

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P3-H-85 ***Considerations for Utilizing the mindBEAGLE's Hybrid BCI-Based Paradigms in Bilingual Patients with Decompressive Hemicraniectomy and Hydrocephalus: A Case Study***

Amber Lieto [1], Amy Wagner [2], Sarah Baker [2], Evelyn Mariperisena-Meinert [1], Siulam Koo [2], Arthur Yan [2], Kevin Franzese [2], Gary Galang [2], Amy Bauer [2], Nabela Enam [3], Katharine "Katya" Hill [1]

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P3-H-86 ***Brain-Computer Interface Operation in Virtual Reality for Children with Complex Mobility Needs***

Philippa Madill [1], Ehud Sharlin [1], Eli Kinney-Lang [1]

[1] University of Calgary

P3-H-87 ***Towards Multimodal BCIs for Access: A Performance & Usability Comparison of Individual Modalities***

Erica Floreani [1], Tom Chau [1]

[1] University of Toronto

P3-H-88 ***Theta-to-Alpha Frequency Ratio as an Indicator of Mindfulness During Binaural Beat Listening***

Merlin Kelly [1]

[1] University College London

P3-H-89 ***Efficacy of Recalibration for a P300 Speller***

Katherine Colleran [1], Guoxuan Ma [1], Jane Huggins [1]

[1] University of Michigan

P3-H-90 ***Designs for no-control functionality using dynamic stopping algorithms as gatekeepers in P300 BCIs***

Jane Huggins [1], Guoxuan Ma [1]

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