Program

2017 ISPGR WORLD CONGRESS

June 25 to June 29, 2017
Fort Lauderdale, Florida, USA

Westin Fort Lauderdale
Beach Resort

ispgr

International Society of Posture & Gait Research

www.ispgr.org

PROGRAM AT A GLANCE

Time	Sunday, June 25	Monday, June 26				Tuesday, June 27				Wednesday, June 28			Thursday, June 29			
8:00 AM																
8:15 AM																
8:30 AM	Pre-conference workshops	Oral 1 (8:30 - 10:30)	Oral 2 (8:30 - 10:30)	Oral 3 (8:30 - 10:30)	Oral 4 (8:30 - 10:30)	Oral 5 (8:30 - 10:30)	Oral 6 (8:30 - 10:30)	Oral 7 (8:30 - 10:30)	Oral 8 (8:30 - 10:30)	Alice Nieuwboer - Keynote Lecture 4 (8:30 - 9:30)			Oral 9 (8:30 - 10:30)	Oral 10 (8:30 - 10:30)	Oral 111 (8:30 - 10:30)	Oral 12 (8:30 - 10:30)
8:45 AM																
9:00 AM										Emerging Scientist Talk (9:30 - 9:50)						
9:15 AM																
9:30 AM										Yes/No Debate (9:50 - 10:30)						
9:45 AM																
10:00 AM																
10:15 AM																
10:30 AM		Posters Session 1 & Exhibitors (10:30 - 12:30) Refreshments provided				Posters Session 2 & Exhibitors (10:30 - 12:30) Refreshments provided				Refreshment Break (10:30 - 11:00)			Posters Session 3 & Exhibitors (10:30 - 12:30) Refreshments provided			
10:45 AM																
11:00 AM																
11:15 AM										Symposium 7 (11:00 - 1:00)	Symposium 8 (11:00 - 1:00)	Symposium 9 (11:00 - 1:00)				
11:30 AM	Free Time															
11:45 AM																
12:00 PM																
12:15 PM																
12:30 PM	Pre-conference workshops	Lunch & Exhibits (12:30 - 1:30)				Lunch & Exhibits (12:30 - 1:30)				Excursions/Free Time			Lunch & Exhibits (12:30 - 1:30)			
12:45 PM																
1:00 PM																
1:15 PM																
1:30 PM		Susan L. Whitney - Keynote Lecture 2 (1:30 - 2:30)				Steve H. Collins - Keynote Lecture 3 (1:30 - 2:30)							Bill McIlroy - Keynote Lecture 4 (1:30 - 2:30)			
1:45 PM																
2:00 PM																
2:15 PM																
2:30 PM		Honourary Member Presentation (2:30 - 3:00)				PSA Talk (2:30 - 3:00)							AGM (2:30 - 3:00)			
2:45 PM																
3:00 PM		Refreshment Break (3:00 - 3:30)				Refreshment Break (3:00 - 3:30)							Refreshment Break (3:00 - 3:30)			
3:15 PM																
3:30 PM	Free Time	Symposium 1 (3:30 - 5:15)	Symposium 2 (3:30 - 5:15)	Symposium 3 (3:30 - 5:15)		Symposium 4 (3:30 - 5:15)	Symposium 5 (3:30 - 5:15)	Symposium 6 (3:30 - 5:15)					Symposium 10 (3:30 - 5:15)	Symposium 11 (3:30 - 5:15)	Symposium 12 (3:30 - 5:15)	
3:45 PM																
4:00 PM																
4:15 PM																
4:30 PM	Opening Ceremony (4:30pm - 5:00pm)															
4:45 PM																
5:00 PM	Grégoire Courtine Keynote Lecture 1 (5:00pm - 6:00pm)															
5:15 PM		Committees Meeting (5:15-5:45)											Closing Ceremony (5:15 - 5:45)			
5:30 PM																
6:00 PM																
6:30 PM	Opening Reception (6:00pm - 7:30pm)															
7:00 PM																
7:30 PM																
8:00 PM	Free Time	Free time				Free time							Closing Dinner (7:00 - 1:00)			
8:30 PM																
9:00 PM																
10:00 PM																
11:00 PM																
12:00 AM																
1:00 AM																

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ABOUT ISPGR

The International Society of Posture and Gait Research (ISPGR) is a member driven organization with 500+ members located in over 20 countries around the world.

The society provides a multidisciplinary forum for basic and clinical scientists, provides member benefits and holds regular meetings to:

- Present and discuss the latest research and clinical findings related to the control of posture and gait and related disorders.
- Facilitate interaction between members who meet from all corners of the globe.
- Promote the broad discipline of posture and gait research.

ISPGR History

The International Society for Posture and Gait Research was formed in 1969 under the name the International Society of Posturography, by a group of basic scientists and clinicians who had similar interests in quantifying postural sway during stance. Most of the Society members in the first years were from Europe and Japan.

The first meetings took place in *Madrid* (1971), *Smolenica* (1973), *Paris* (1975), *Sofia* (1977), *Amsterdam* (1979), *Kyoto* (1981) and *Houston* (1983). At the 1983 meeting in Houston the founders realized that interest in posturography had expanded to include the entire act of balance and gait control and at the annual meeting in 1986, the Society was renamed to its current name. By the 1992 meeting in *Portland, Oregon*, the Society had grown to over 300 members worldwide and member interests expanded to include sensory and motor control neurophysiology, biomechanics, movement disorders, neural circuitry, vestibular function, neurological disorders, effects of development and aging, rehabilitation, robotics, modeling, neural compensation, and motor learning as related to control of balance and gait.

WELCOME LETTER

Dear Colleagues,

We are honored and delighted to act as co-chairs for the 2017 World Congress of the International Society of Posture and Gait Research and welcome you to the "gateway to the Everglades" city of Fort Lauderdale, Fl.

This is the second conference with a venue that is chosen independently of any academic affiliations of the co-chairs. The society will follow this model for future conferences so that they can continue to offer their members easy accessibility to the conference location, professional conference organization, affordable conference facilities, and above all fascinating content during the scientific conference.

The city of Fort Lauderdale is a popular Floridian tourist destination just north of Miami. With an average monthly temperature exceeding 18˚C it has a tropical climate. No wonder that the beaches are one of the biggest attractions of Fort Lauderdale. As students of posture and gait, the members of the ISPGR must surely appreciate the intricacies of walking on beach sand or maintaining balance while standing in the breakers. In good scientific fashion we encourage you to apply all the knowledge that you gain during the conference to your mobility research at the beach!

We are excited to offer you a diverse and exciting scientific program. The large number of excellent abstract submissions and symposium proposals allowed us to provide a balanced program of oral sessions and symposiums. We are especially excited to introduce interactive technology during the symposiums. A smartphone application will be made available for download to all attendees. With this application the audience can be polled about their opinions during a symposium. We hope that this interactive approach will encourage and promote active participation by the audience members and provide a tool for a vivid discussion during the symposium. We also want to extend our sincere thanks to the keynote speakers who have carefully been selected based on the translational nature of their work and who will undoubtedly provide very exciting talks about the current state of knowledge in their respective fields of research.

To encourage attendance throughout the day we have scheduled the oral presentations in the morning, the keynote presentations immediately following the lunch break, and the symposiums in the afternoon. As with all conferences we provide ample time for the poster presentations. We are also excited to announce the return of the famous yes/no debates. Finally, we also want to direct your attention to the excellent talks that will be given by the winners of the Promising Scientist Award and the Emerging Scientist Award. Of course, we also encourage you to visit our sponsors in the exhibition spaces who will showcase their latest technology and who will undoubtedly play a role in your future research endeavors.

We want to thank all the individuals who have dedicated their time to help organize this congress. In particular we want to thank the members of the scientific content committee and its chair Dr. Mark Hollands, who have worked hard to help us objectively select the best and most interesting abstracts for the conference. We are also grateful to the members of the awards committee for their excellent choices for the Promising and Emerging Scientists Awards, for selecting – for the first time – five travel grant winners from close to one hundred entries, and for the daunting task of choosing the two best student posters for the Aftab Patla Innovation Award. We also would like to thank the ISPGR board members, and in particular its President Dr. Mark Carpenter, for their feedback and continued support. Most importantly, we want to thank you for your individual contributions and efforts to help make this a memorable and successful conference.

Vivian Weerdesteyn, PhD
Congress Co-Chair:

Martijn Muller, PhD
Congress Co-Chair

LEADERSHIP

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Mark Carpenter (Americas)
University of British Columbia, Canada

Vice President

Mark Hollands (Europe)
Liverpool John Moores University, United Kingdom

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Mirjam Pijnappels (Europe)
MOVE Research Institute

Masahiro Shinya (Asia-Pacific)
The University of Tokyo

Vivian Weerdesteyn (Europe)
Radboud University Medical Centre

William Geoffrey Wright, (Americas)
Temple University

2016/2017 Scientific Committee Representatives

Committee Co-Chairs:

Mark Hollands	Liverpool John Moores University
Martijn Muller	University of Michigan
Vivian Weerdesteyn	Radboud University Medical Centre

Committee Representatives:

Fabio Augusto Barbieri	University Estadual Paulista
Tanvi Bhatt	University of Illinois
Mihalis Doumas	Queens University Belfast
Brook Galna	Newcastle University
Kristen Hollands	University of Birmingham
Yuri Ivanenko	Fondazione Santa Lucia
Klaus Jahn	University of Munich
Stephen Lord	Neuroscience Research Australia
Manuel Montero Odasso	Western University
Toshihisa Murofushi	Teikyo University
Dominic Pérennou	Institute of Rehabilitation - CHU Grenoble, BP 338
Mirjam Pijnappels	VU University
Rebecca Reed-Jones	University of Prince Edward Island
Shirley Rietdyk	Purdue University
Kathryn Sibley	University of Manitoba
Patrick Sparto	University of Pittsburgh
John Stins	Research Institute MOVE
Herman van der Kooij	Delft University
Will Young	Brunel University

FUTURE MEETING

Notes

CONGRESS GENERAL INFORMATION

Meeting Venue

The Westin Fort Lauderdale Beach Resort
321 North Fort Lauderdale Beach Boulevard
Fort Lauderdale, Florida 33304

(please review the floor plan at the back of the program for further details)

Registration

World Congress Registration
Registration for the Congress includes admission to all sessions (excluding pre-congress workshops), access to all coffee breaks and lunches daily. In addition, all social events, including the Welcome Reception and Gala Dinner are included in your registration.

Additional Tickets
Pre-Congress Workshops require advance registration and **cost $45**.

Tickets can be purchased separately for your guests and/or children for all conference excursions, the Welcome Reception ($35 for adults, $20 for children), and Gala Dinner ($95 for adults, $65 for children).

Name Badges
Your name badge is your admission ticket to the conference sessions, coffee breaks, meals, reception and Gala. Please wear it at all times. At the end of the conference we ask that you return your badge to the registration desk, or at one of the badge recycling stations.

ISPGR Board Members, Exhibitors and Staff will be identified by appropriate ribbons.

Dress Code
Dress is casual for all ISPGR meetings and social events.

Registration and Information Desk Hours
The Registration and Information Desk, located in the foyer, will be open during the following dates and times:

Sunday	June 25	07:30 – 09:30 15:00 – 18:00
Monday	June 26	08:00 – 17:30
Tuesday	June 27	08:00 – 13:00
Wednesday	June 28	08:00 – 17:30
Thursday	June 29	08:00 – 16:00

Speaker Information
For Oral Sessions, each room will be equipped with

- 1 PC laptop
- 1 LCD projector
- 1 microphone
- 1 laser pointer

If you have any questions please visit the registration desk.

Poster Information

Set-up and Removal
There are three Poster Sessions during the Congress. Poster presenters must set-up and remove their posters during the following times:

Poster Session 1

Set-up:	Monday, June 26	07:30 – 08:30
Dedicated time:	Monday, June 26	10:30 – 12:30
Remove:	Monday, June 26	by 18:00

Poster Session 2

Set-up:	Tuesday, June 27	07:30 – 08:30
Dedicated time:	Tuesday, June 27	10:30 – 12:30
Remove:	Tuesday, June 27	by 18:00

Poster Session 3

Set-up:	Thursday, June 29	07:30 – 08:30
Dedicated time:	Thursday, June 29	10:30 – 12:30
Remove:	Thursday, June 29	by 18:00

Information on Poster Authors (Lead), Poster Numbers and Poster Titles begins on page 56.
For a complete copy of all the poster abstracts, please visit the ISPGR website, where you can download an electronic copy or use the Congress app.

Easy reference Poster Floor Plans can be found on page 84 or use the Congress app.

Staff

ISPGR staff from Podium Conferences can be identified by the orange ribbons on their name badges. Feel free to ask any one of our staff for assistance. For immediate assistance please visit the registration desk.

Internet Services

IPSGR attendees have access to complimentary WI-FI in the meeting space area.

WI-FI Intructions:
Username: **Westin Meeting Room**
Password: **ispgr2017**

INTERNATIONAL SOCIETY FOR POSTURE & GAIT RESEARCH

Membership

Membership in ISPGR is open to scientists, researchers, clinicians and students from around the world involved in the many research and practical aspects of Gait and Posture. Membership dues support the ISPGR's mission of creating a community of multidisciplinary posture and gait researchers and students.

Member Benefits

- Exclusive opportunity to **submit abstracts** for review and consideration for presentation at Society Meetings
- Opportunity to register for Society Meetings at **reduced registration rates**
- Professional **development and networking**
- Access to **online resources** and conference proceedings
- 20% discount on a subscription to ISPGR's official publication, Posture & Gait, published by Elsevier 8 times per year
- Opportunity to submit applications for **student scholarships and awards**
- Ability to post and review **job and grant opportunities**
- Opportunity to post **news and information** on related events
- Opportunity to **vote** in annual elections for the Board of Directors
- Opportunity to **stand for election** to the Board of Directors
- Opportunity to **serve as an officer** of the Board of Directors
- Opportunity to **serve on Society committees**

Member Categories

Regular Members
Any person who is engaged in research or clinical practice related to posture and gait is eligible to be a regular member.

Student and Post Doc Members
Students enrolled in degree granting programs at institutions of higher learning and post doctoral fellows are eligible to be student members.

Member Dues
ISPGR membership dues are paid annually and cover the calendar year from October 1 to September 30 each year. Current membership dues are:

Regular Member **$150**
Student/Post-Doc Member **$75**

Committee Involvement

ISPGR would like to know which members are keen to be actively involved on the following society committees:

- **External Relations Committee:** for members with access to corporate networks and a willingness to approach sponsors
- **Communications Committee:** for members comfortable with website content, correspondence and social media
- **Awards Committee:** for members available to review award applications in January and also onsite at the world congress

If you would like to learn more about committees or the society, please attend the Committee meeting on **Monday, June 26 in the Rio Vista room from 5:15pm - 5:45pm**. This is an informal way to chat with members of the various committees and ask questions. Alternatively, please arrange a face-to-face meeting with a current board member at the World Congress either through the member community area on the website or by visiting the registration desk.

SNORKELING ADVENTURE

Meeting Time: 1:45pm – please arrive on time!

Meeting Point: Sea Experience Snorkel located at the Bahia Mar Yachting Center - 801 Seabreeze Boulevard. Participants are responsible for their own transportation to and from the meeting point. It is a 25-minute walk from the Westin Fort Lauderdale Beach Resort.

Ticket Price: $55 USD

The 2 ½ hour trip starts with a narrated tour through Millionaires Row on the Intracoastal Waterway to Port Everglades and then we head out to the beautiful Ft. Lauderdale, Florida's ocean waters. The reef, named the Fort Lauderdale Twin Ledges, is a natural coral reef and is from 7' at the shallowest point to 20' at the deepest and hosts a variety of colorful marine life. You will be absolutely amazed at the underwater world that lives just right off the shores. We spend approximately an hour at the reef where you have the option of either snorkeling or staying dry and enjoying the view through one of two 3' x 9' glass bottom viewing wells on the boat. We will then cruise back along the beach as we head back to the dock where we conclude the snorkeling tour.

- Prices for the snorkeling trip include all snorkeling equipment, including a snorkel vest and instruction on how to snorkel.
- There is no minimum age to participate, but **basic swimming skills are required.**

FLORIDA EVERGLADES NIGHT ADVENTURE

Meeting Time: 8:15pm

Meeting Point: Please meet in the lobby of the hotel – transportation is included. Bus will pick up at the Westin Fort Lauderdale Beach Resort.

Ticket Price: $50 USD

Enjoy a wild and crazy **60-minute airboat ride through the mysterious Florida Everglades at night**. During your night tour through the Everglades, you'll listen to engaging tales including how the Seminole and panther once coexisted in this lush wilderness. But don't get so caught up in the stories that you forget to keep your eyes peeled for a heart stopping glimpse of the endangered wildlife as you skim across the glassy waters of the untamed Everglades at night!

AFTERNOON EVERGLADES EXPLORATION WITH EXHIBITS AND FREE TIME ON LAS OLAS BLVD

Meeting Time: 2:30pm

Return Time: 7:30pm

Meeting Point: Please meet in the lobby of the hotel – transportation is included. Bus will pick up at the Westin Fort Lauderdale Beach Resort.

Ticket Price: $55 USD (tickets must be purchased at time of registration)

Marvel at the vast Everglades Ecosystem during your interactive airboat tour and informative exhibits. At Everglades Excursion, we don't just tour, WE EXPLORE. As you glide over the water, through the Sawgrass and around hammocks, be on the lookout for the many animals, reptiles, and birds that call the Everglades home. Your experienced Gladesman, during this interactive exploration will discuss the relevance of the Everglades on Florida's history as well as present day society. Your Gladesman may even show you how to survive in Everglades by creating band-aids and eating edible plants. Your interactive and hands on exploration of the Everglades continues as you explore the exhibits, wildlife shows, and have the opportunity to hold a baby alligator. Following our Exploration, drive through downtown Fort Lauderdale to Las Olas Boulevard where you will have between 1 hour and 1.5 hours to experience the shops, galleries, and restaurants. Should you wish to extend your stay on Las Olas, it is only a 3 mile, 8 minute drive back to the hotel.

Inclusions:

- Tour Director exclusively for your group who will be with you throughout the exploration
- Explore the Everglades in a 30 to 35 minute interactive private airboat ride
- Hold a baby alligator
- Interactive shows
- Informative exhibits
- Free time on Las Olas Blvd.

**Transportation and complimentary bottled water and snacks are included.*

08:30 – 11:30 Morning Session

8:30am – 10am

Gait and Posture Authors' Workshop

Location: Oceanside II

Are you an early-career researcher interested in publishing your work in Gait and Posture? If so, please attend this workshop which will take you through the manuscript submission, review, publication and post-publication process and which will allow you to ask any questions you may have. Topics covered will include preparation of the article; authors' rights and responsibilities; getting your paper noticed; open access; and bibliometrics including the Impact Factor.

Presented by *Gait and Posture*'s Editor-in-Chief, **Thomas Dreher**; Deputy Editor, **Julie Stebbins**; and Senior Publisher from Elsevier, **Tanya Wheatley**.

**This workshop will be offered free of charge to ISPGR Conference Delegates.*

10:15am – 11:45am

Gait and Posture Reviewers' Workshop

Location: Oceanside II

Are you interested in becoming a vital part of the publication process and in receiving early access to as-yet unpublished work? If so, please do come along to this workshop and learn how to review submitted manuscripts and how you can become a reviewer for Gait and Posture.

Presented by *Gait and Posture*'s Editor-in-Chief, **Thomas Dreher**; Deputy Editor, **Julie Stebbins**; and Senior Publisher from Elsevier, **Tanya Wheatley**.

**This workshop will be offered free of charge to ISPGR Conference Delegates.*

Workshop 1 *Location: Rio Vista I*

Movement-dependent event control: principles and applications

Melvyn Roerdink[1], Celine Timmermans[1], Daphne Geerse[1], Bert Coolen[1]
[1]Research Institute MOVE, VU University Amsterdam

Experimental manipulations in studies on walking often involve the control and registration of events in the actor-environment system. Often, these events are determined in parallel on the basis of current movement characteristics. Examples are avoidance of an obstacle presented one step ahead or responding to a secondary-task stimulus presented at a particular phase during walking. In these examples events are controlled in a movement-dependent manner, that is, features in the movement trigger the events. This is different from external event control, in which events are controlled independent of the unfolding movement, for example at set times or upon a button press of the experimenter. The goal of this workshop is to get attendees familiar with the basic principles and benefits of movement-dependent event control through lecture-like plenary presentations. A second goal is to offer attendees hands-on experience with movement-dependent event control applications through three different interactive demos in smaller rotating groups: 1) augmented-reality treadmill walking (gaitography to control 2D visual context projected onto the treadmill surface; C-Mill demo), 2) augmented-reality overground walking (a multi-Kinect-v2 instrumented 10m walkway to control 2D visual context; Interactive Walkway demo) and 3) mixed-reality overground walking (depth scanning of the 3D surroundings for pinning 3D holographic content; Hololens-based Holobstacle demo).

12:30 – 3:30 Afternoon Session

Workshop 2 *Location: Rio Vista II*

Motor cognitive interactions and their impact on gait: From mechanisms to evidence-based treatment

Anat Mirelman[1], Lynn Rochester[2], Alice Nieuwboer [3], Jeffrey Hausdorff[1]
[1]Tel Aviv Sourasky Medical Center, [2]Institute of Neuroscience, Newcastle University Institute for Ageing, Newcastle University, [3]Rehabiliation Sciences, Katholick University

The goals of this workshop are: - To review recent and emerging evidence which links gait and falls in aging and neurodegeneration. Behavioral, imaging, and neuropsychological findings will be presented. - To describe different options for assessing motor cognitive interactions during walking. Behavioral paradigms will be reviewed and critiqued and the pros and cons of different cognitive loads will be described. Participants will learn how to optimally conduct studies and clinical applications. - To demonstrate the utility of different imaging techniques (e.g., fMRI, fNIRS) in assessing motor cognitive interactions. Participants will learn how these methods can be applied to investigate and quantify motor-cognitive interactions and dependencies. - To describe studies using dual task training and virtual reality demonstrating how the targeting of motor-cognitive training improves walking under challenging conditions and reduces the risk of falls. Participants will learn how dual tasking abilities can be improved and what techniques can be applied in research and clinical settings.

Workshop 3 *Location: Bonnet I*

Rehabilitation technology to improve gait & balance: from research to clinical practice

Frans Steenbrink[1], Jaap van Dieen[2], Sanne Roeles[3], Adam Booth[4], Celine Timmermans[2]
[1]Motek Medical, [2]VU University, [3]Strathclyde University, [4]VU Medical Center

In this workshop we will outline the state-of-the-art of currently available technology for gait and balance rehabilitation. More specifically, we will focus on real-time visual feedback, gait adaptability, and gait perturbations. Real-time visual feedback can help to train on specific gait impairments to regain a normal gait pattern. For example, elderly can be given visual feedback on their propulsive ground reaction force to improve push-off. Although visual feedback can aid retraining of regular gait, we believe that everyday walking is more than just setting one foot in front of the other. It also requires the ability to adjust your walking pattern to different situations and to react to unexpected perturbations. For example, you may need to lift your leg up higher to avoid tripping over a loose tile, slow down to avoid bumping into someone, or recover balance after a slip. Training gait adaptability and recovering from perturbations may therefore be essential elements of gait rehabilitation. In this workshop we will introduce the different concepts related to rehabilitation technology to improve balance and gait from a research perspective and evaluate their usefulness for assessment and training. Together, we will think of examples of how these concepts can be integrated in clinical practice. Also, we will interactively show and adjust several applications using motion capture and virtual reality technologies, and invite you to engage in our discussion on how we can use technology for gait retraining in clinical research and practice.

Workshop 5 *Location: Bonnet II*

Objective measurement of free-living physical behaviour: what can it tell us about physical capacity in persons with mobility limiting conditions?

Malcolm Granat[1], David Loudon[2], Nicholas Smith[3]

[1]University of Salford, [2]PAL Technologies Ltd, [3]University of Strathclyde

The main goal of this workshop is to demonstrate how we can derive person-centred outcomes that reflect physical capacity from body-worn senor data. From our study of physical behaviours we know people have basic free-living physical requirements. We can look at these in terms of ability (for example rising from a chair) and connect this with participation (how often do you stand up). In terms of mobility, we know people make short duration stepping bouts around the house but when they go outside they must engage in longer bouts of stepping. We can calculate a Walking Breaks Index to compare upright periods with short and long stepping bouts and use this index to quantify impairment in persons with mobility limiting conditions. We will look at how measures physical capacity can be generated from wearable sensors in a range of clinical populations including people with stroke and vascular disease (claudication). We will explore the advantages of combining sensor signals (accelerometers, gyroscopes, magnetometers and barometers) to provide contextual information about behaviours. We will also explore novel ways of visualising physical behaviour information can both complement and inform analysis for both clinician and patient. Participants will take away an appreciation of how the measurement of physical behaviour can provide objective outcomes related to physical capacity from patients in a free-living environment and how these measures can provide an insight into and record of their recovery profile.

DETAILED PROGRAM

Please note that the program is Subject to change

Sunday, June 25, 2017

Morning Pre-Congress Workshops

08:30 – 10:00 **Gait and Posture Authors' Workshop**

08:30 – 11:30 **WS 1.** Movement-dependent event control: principles and applications

10:15 – 11:45 **Gait and Posture Reviewers' Workshop**

Afternoon Pre-Congress Workshops

12:30 – 15:30

WS 2. Motor cognitive interactions and their impact on gait: From mechanisms to evidence-based treatment

WS 3. Rehabilitation technology to improve gait & balance: from research to clinical practice

WS 4. Replicating real-life conditions in gait research: challenges and strategies

WS 5. Objective measurement of free-living physical behaviour: what can it tell us about physical capacity in persons with mobility limiting conditions?

Opening of World Congress

16:30 – 17:00 **ISPGR World Congress Opening Ceremony**
location: Las Olas Ballroom

17:00 – 18:00 **Opening Keynote – Grégoire Courtine,** Ecole Polytechnique Fédérale de Lausanne, Switzerland
location: Las Olas Ballroom
Locomotor Neuroprosthetics

Chair: **Vivian Weerdesteyn,** Radboud University Medical Centre, Netherlands

18:00 - 19:30 **Opening Reception**

Monday, June 26, 2017

08:30 - 10:30 Oral Sessions 1 – 4

O.1 Aging *location: Rio Vista*

Co-Chairs:
Fabio Barbieri, Universidade Estadual Paulista (Unesp), Brazil
William Young, Brunel University, UK

O.1.1 ***Depressive symptoms and executive function may be linked to different aspects of standing postural control in older adults.***
Rachel Harrison, Hebrew SeniorLife, United States

O.1.2 ***Texting while walking; effect of age and environment***
Rachel Kizony, University of Haifa, Israel

O.1.3 ***The speed and variability of gait are associated with different functional brain networks in older adults***
On-Yee Amy Lo, Hebrew SeniorLife / Harvard Medical School, United States

O.1.4 ***Head sway restriction by older adults during precise manual motor imagery***
Hayley Boulton, Nottingham Trent University, United Kingdom

O.1.5 ***Combined exercise and cognitive training to improve dual-task balance in older adults***
Karen Li, Concordia University, Canada

O.1.6 ***Old adults drift while stepping in place: influence of ground optic flow and perceptual reference frame reliance on self-motion perception***
Catherine Agathos, Essilor International, France

O.1.7 ***Stepping over obstacles reveals gait changes in middle-aged adults not evident during steady state gait***
Brittney Muir, The Sage Colleges, United States

O.1.8 ***Activity Restriction, Balance Confidence, and History of Falls in Older Adults***
Gabrielle Scronce, University of North Carolina at Chapel Hill, United States

08:30 - 10:30

O.2 Sensorimotor control *location: Oceanside II*

Co-Chairs:
Patrick Sparto, University of Pittsburgh, United States
Brad McFadyen, Laval University, Canada

O.2.1 ***Sensory conflict stimuli as a window into emergence of posture control mechanisms in infants***
Adam Goodworth, University of Hartford, United States

O.2.2 ***Acceleration feedback by muscle spindles contributes to trunk stabilization***
Jaap van Dieen, Vrije Universiteit Amsterdam, Netherlands

O.2.3 ***Central not peripheral vestibular processing impairs gait coordination***
Yoav Gimmon, Johns Hopkins University, United States

O.2.4 ***Effects of walking speed on spatiotemporal gait characteristics and their variability in patients with bilateral vestibulopathy: preliminary observations***
Christopher McCrum, Maastricht University Medical Centre+, Netherlands

O.2.5 ***The effect of compliant support surfaces on sensory reweighting in human balance control***
Ingrid Schut, Delft University of Technology, Netherlands

O.2.6 ***Correlations between multi-plane video head impulse test (vHIT) responses and balance control after an acute unilateral peripheral vestibular deficit.***
John Allum, University Hospital Basel, Switzerland

O.2.7 ***Dynamic balance decrements last longer than 10 days following a concussion***
Christopher Rhea, University of North Carolina at Greensboro, United States

O.2.8 ***Dynamic single-leg balance control between athletes and previously concussed athletes during a visuomotor task.***
Katelyn Mitchell, Wilfrid Laurier University, Canada

08:30 - 10:30 **O.3 Neurological diseases** *location: Las Olas I-III*

Co-Chairs:
Brook Galna, Newcastle University, UK
Doniminic Pérennou, Centre Hospitalier Universitaire de Grenoble, France

O.3.1 ***Impaired ability to sustain balance perturbations in people with chronic stroke and its association with leg and trunk motor function***
Digna de Kam, Radboud University Medical Center, Netherlands

O.3.2 ***Structural and functional connectivity underlying assistive device training-related mobility improvements in people with MS***
Brett Fling, Colorado State University, United States

O.3.3 ***The impact of post-stroke spatial neglect on off- and on-line goal-directed locomotion tasks performed in virtual reality***
Tatiana Ogourtsova, McGill University, Canada

O.3.4 ***How feasible and effective is it for physiotherapists to deliver a high intensity treadmill training and self-management program to stroke patients undergoing rehabilitation?***
Sandra Brauer, University of Queensland, Australia

O.3.5 ***Autism and the processing of optic flow in the periphery***
Susan Morris, Curtin University, Australia

O.3.6 ***Impaired step adjustment in patients with multiple sclerosis and its association with measures of inhibitory control***
Yasaman Sadat Etemadi, Mazandaran University of Medical Sciences, Iran

O.3.7 ***Altered plantarflexor muscle properties in stroke survivors - is there a connection between muscle and impaired gait?***
Kristen Jakubowski, Northwestern University, United States

O.3.8 ***Antagonist muscle activity in postural responses to support-surface translations in exercise-study-eligible people with Parkinson's disease and neurotypical older adults***
Kimberly Lang, Emory Univ., United States

08:30 - 10:30 **O.4 Adaptation, learning, plasticity and compensation**
location: Las Olas IV-VI

Co-Chairs:
Mihalis Doumas, Queens University Belfast, UK
Yury Ivanenko, Fondazione Santa Lucia, Italy

O.4.1 ***Neural Correlates of Split-Belt Treadmill Gait Adaptation: A Systematic Review***
Dorelle Hinton, McGill University, Canada

O.4.2 ***Age and dual task effects on gait adaptability during split-belt walking***
Danique Vervoort, University Medical Center Groningen (UMCG), Netherlands

O.4.3 ***Relation between Dynamic Balance Control and Metabolic Cost during Split Belt Adaptation***
Tom Buurke, University Medical Center Groningen,
University of Groningen, Netherlands

O.4.4 ***Differentiated Gait Adaptation Patterns in Subjects with Parkinson's disease - a Split Belt Tread Mill Study***
Evyatar Arad, Sheba Medical Center, Israel

O.4.5 ***Disparate effects of motor-cognitive training and motor training alone on brain activation in patients with Parkinson's disease: an fMRI study***
Inbal Maidan, Sourasky medical center, Israel

O.4.6 ***Gait initiation in people with corticospinal lesions: insights from StartReact***
Bas van Lith, Radboudumc, Netherlands

O.4.7 ***Learning to balance on a slackline: Kinematic and spinal reflex adaptations***
Robyn Mildren, University of British Columbia, Canada

O.4.8 ***Repeated exposure to height-related postural threat: how do humans adapt?***
Martin Zaback, University of British Columbia, Canada

10:30 – 12:30 **Poster Session 1 & Exhibitors** (refreshments provided)

12:30 – 13:30 **Lunch & Exhibits**

13:30 – 14:30 **Keynote Presentation** *location: Las Olas Ballroom*
Susan L. Whitney, University of Pittsburgh, United States
Vestibular rehabilitation: A multidisciplinary collaboration
Chair: **Pat Sparto**

14:30 – 15:00 **Honorary Member Presentation** *location: Las Olas Ballroom*

15:00 – 15:30 **Refreshment Break**

15:30 – 17:15 **Symposia 1–3**

S.1 ***Balance and gait changes in preclinical stages of neurodegenerative movement disorders - Commonalities, specificities, open questions and future steps***
location: Las Olas I-III
Co-Chairs
Winfried Ilg, Hertie Institute for Clinical Brain Research, Germany
Jeffrey M. Hausdorff, Center for the Study of Movement Cognition and Mobility, Tel Aviv Sourasky Medical Center, Israel

Participants
Anat Mirelman, Tel Aviv Sourasky Medical Center, Israel
Joan A. O'Keefe, Rush University Medical Center, United States
Winfried Ilg, Hertie Institute for Clinical Brain Research, Germany

S.2 ***Using smart technology in the prevention of age-related decline in balance, strength, physical activity and behavioral complexity***
location: Las Olas IV-VI
Co-Chairs
Jorunn L Helbostad, Norwegian University of Science and Technology, Norway
Beatrix Vereijken, Norwegian University of Science and Technology, Norway

Participants
Michael Schwenk, Robert-Bosch Hospital, Germany
Anisoara Ionescu, Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland
Elisabeth Boulton, University of Manchester, UK
Sabato Mellone, Alma Mater Studiorum - University of Bologna, Italy

S.3 ***Noninvasive brain stimulation: a research and rehabilitative tool for gait and postural control.***
Chair
Talia Herman, Tel Aviv University, Israel

Participants
Brad Manor, Harvard Medical School, United States
Moria Dagan, Sagol School of Neuroscience, Tel Aviv University, Israel
Manuel Montero-Odasso, Western University, Canada

17:15 – 17:45 **Committee Meeting**
location: Oceanside I

Tuesday, June 27, 2017

08:30 - 10:30 **Oral Sessions 5 – 8**

O.5 Brain imaging/activation *location: Rio Vista*

Co-Chairs:
Klaus Jahn, Schoen Klinik Bad Aibling and University of Munich, Germany
Anat Mirelman, Tel Aviv Sourasky Medical Center, Israel

O.5.1 ***Quantifying the executive demand of walking with fNIRS neuroimaging***
Kelly Hawkins, University of Florida, United States

O.5.2 ***When is higher level cognitive control needed for locomotor tasks among patients with Parkinson's disease?***
Inbal Maidan, Sourasky medical center, Israel

O.5.3 ***Potential of non-invasive brain stimulation to ameliorate freezing of gait in Parkinson's disease: A deep repetitive TMS randomized, double-blinded, cross-over pilot study***
Moria Dagan, Sagol School of Neuroscience, Tel Aviv University, Israel

O.5.4 ***HActivity of the subthalamic and pedonculopontine nuclei during initiation of gait: an electrophysiological approach in humans***
Antoine Collomb-Clerc, Institut du cerveau et de la Moelle Epinière, France

O.5.5 ***Vestibulocerebellar cholinergic loss is associated with turning characteristics during walking in mild-to-moderate Parkinson disease.***
Martijn Muller, University of Michigan, United States

O.5.6 ***Does cortical activity evoked by postural perturbations scale with acceleration?***
Aiden Payne, Georgia Tech & Emory, United States

O.5.7 ***Association between Regional Cerebral Cholinergic Denervation and Gait and Postural Stability in Parkinson's Disease***
Mélanie Beaulieu, University of Michigan, United States

O.5.8 ***Neural representation of reactive balance control of slipping while walking: Differences in brain activation during action observation versus mental imagery***
Tanvi Bhatt, University of Illinois at Chicago, United States

O.6 Cognitive, attentional, and emotional influences *location: Oceanside II*

Co-Chair:
Kim Delbaere, University of New South Wales, Australia

O.6.1 ***Concurrent Phone Texting Alters Crossing Behavior and Induces Gait Imbalance during Obstacle Crossing***
Li-Shan Chou, University of Oregon, United States

O.6.2 ***No association between depressive symptoms and gait or balance in patients with cognitive impairments and Alzheimer's disease***
Gro G. Tangen, Norwegian National Advisory Unit on Ageing and Health/University of Oslo, Norway

O.6.3 ***Re-conceptualising anxiety-related reinvestment in older adults***
Will Young, Brunel University, United Kingdom

O.6.4 ***Sympathetic nervous system activity as an assessment of perceived challenge of walking after stroke***
David Clark, North Florida/South Georgia Veterans Health System, United States

O.6.5 ***Visual scanning behavior during attention-demanding tasks while walking in healthy young adults***
Jody Feld, University of North Carolina at Chapel Hill, United States

O.6.6 ***How do anxiety, falls efficacy, and movement specific reinvestment influence segmental control of older adults during adaptive turning?***
Adam Cocks, Brunel University London, United Kingdom

O.6.7 ***Gait Disturbances In Older Individuals With Mild Cognitive Impairment: Are They Caused By A Motor Planning Problem?***
Frederico Pieruccini-Faria, University of Western Ontario, Canada

O.6.8 ***Motor switching benefits rather than costs during gait-related tasks***
Katrijn Smulders, Oregon Health & Science University, United States

O.7 Falls and fall prevention *location: Las Olas I - III*

Co-Chairs:
Shirley Rietdyk, Purdue University, United States
Mirjam Pijnappels, Vrije Universiteit Amsterdam, Netherlands

O.7.1 ***Similarity of repeated falls in older people: do past falls predict the circumstances of future events?***
Kim van Schooten, Simon Fraser University, Canada

O.7.2 ***Successful landing during a fall: Video evidence of the strategies used by older adults in long-term care to avoid head impact during real-life falls***
Stephen Robinovitch, Simon Fraser University, Canada

O.7.3 ***Charting falls over 54 months in newly diagnosed Parkinsons disease: which early features discriminate fallers and falls type?***
Sue Lord, Newcastle University, United Kingdom

O.7.4 ***Influence of initial limb load and hip abductor-adductor muscle performance on lateral protective stepping in younger and older adults.***
Mario Inacio, University of Maryland School of Medicine, United States

O.7.5 ***Intervention to Enhance Lateral Balance Function and Prevent Falls in Aging: First Results from the LIFT Study***
Mark Rogers, University of Maryland School of Medicine, United States

O.7.6 ***Circumstances leading to inadvertent trips in the lab for young, middle-aged and older adults***
Brittney Muir, The Sage Colleges, United States

O.7.7 ***Neuromuscular, cognitive, and behavioral factors contributing to falls***
Rachel Ward, VA Boston, United States

O.7.8 ***VIP2UK feasibility randomised controlled trial: A feasibility study of Home-Exercise vs Home-Exercise & Home-Safety vs Control to prevent falls in older people who are visually impaired.***
Chris Todd, University of Manchester, United Kingdom

O.8 Rehabilitation *location: Las Olas IV-VI*

Co-Chairs:
Melvyn Roerdink, MOVE, Vrije Universiteit Amsterdam, Netherlands
Kristen Hollands, University of Salford, UK

O.8.1 ***Effectiveness of additional trunk exercises on gait performance: A randomized controlled trial***
Tamaya Van Criekinge, UAntwerpen, Belgium

O.8.2 ***The effect of a combined motor-cognitive training, Thinking in Motion, versus a cognitive training on gait and cognition in older adults: a randomized clinical trial***
Maayan Agmon, University of Haifa, Israel

O.8.3 ***Implanted functional electrical stimulation for post-stroke drop foot: an analysis of kinematic and kinetic benefits at push-off and initial swing.***
Frank Berenpas, Radboudumc, Netherlands

O.8.4 ***Continuous versus intelligent cueing and feedback for gait in people with Parkinson's disease: One size does not fit all***
Pieter Ginis, KU Leuven, Belgium

O.8.5 ***C-Gait: automatized, standardized and patient-tailored walking adaptability training***
Celine Timmermans, Vrije Universiteit, Netherlands

O.8.6 ***Internal model of verticality: neuromodulation through body-weight support in a tilted virtual environment***
Dominic Pérennou, University Hospital Grenoble-Alpes, France

O.8.7 ***Recalibration of perceived postural capabilities mediates post-intervention improvements in older-adult functional balance***
Toby Ellmers, Brunel University London, United Kingdom

O.8.8 ***Long-term balance training with vibrotactile sensory augmentation in community dwelling older adults***
Tian Bao, University of Michigan, United States

10:30 – 12:30	**Poster Session 2 & Exhibitors** (refreshments provided)
12:30 – 13:30	**Lunch & Exhibits**
13:30 – 14:30	**Keynote Presentation** *location: Las Olas Ballroom* **Steve H. Collins,** Carnegie Mellon University, United States ***Designing exoskeletons and prostheses that enhance human performance*** Chair: **Lena Ting,** Emory University and Georgia Tech
14:30 – 15:00	**PSA Talk**
15:00 – 15:30	**Refreshment Break**
15:30 – 17:15	**Symposia 4 – 6**

S.4 ***(E)motion: The effect of emotion on human posture and gait control in health and illness***

Chair
John Stins, Vrije Universiteit, Netherlands

Participants
Brad Fawver, University of Utah, United States
Mihalis Doumas, Queens University, Canada
Laura Avanzino, University of Genoa, Italy
Jeffrey Staab, Mayo Clinic, United States

S.5 ***Implementation research in balance, mobility and fall prevention: How do we move the evidence into action?***

Chair
Kathryn Sibley, University of Manitoba, Canada

Participants
Kathryn Sibley, University of Manitoba, Canada
Stephen Lord, Neuroscience Research Australia, Australia
Debra Rose, California State University, Fullerton, United States
Chris Todd, University of Manchester, United Kingdom

S.6 ***Peeking inside the brain - How to study the neural control of walking?***

Chair
Vivian Weerdesteyn, Radboud University Medical Centre, Netherlands

Participants
Brett Fling, Colorado State University, United States
Noel Keijsers, Sint Maartenskliniek, The Netherlands
Daniel Ferris, University of Michigan, United States

DETAILED PROGRAM

Wednesday, June 28, 2017

08:30 – 09:30 **Keynote presentation** *location: Las Olas Ballroom*

Alice Nieuwboer, KU Leuven

The enigma of facing impaired basal ganglia for gait control and rehabilitation

Chair: **Martijn Muller,** University of Michigan, United States

09:30 – 09:50 **Emerging Scientist Talk**

09:50 – 10:30 **Yes/No Debate**

1. Are associations between gait and cognition overrated?

Katrijn Smulders, Oregon Health & Science University, United States
Lynn Rochester, Newcastle University, UK

2. Comparing older adult groups and clinical groups to young adults: is this a good experimental design?

Rebecca Reed-Jones, University of Prince Edward Island, Canada
Kara Patterson, University of Toronto, Canada

10:30 – 11:00 **Refreshment Break**

11:00 – 13:00 **Symposia 7–9**

S.7 ***Vestibular and cerebellar control of posture and gait - Neurophysiology and Clinical Applications***

Chair
Roman Schniepp, Ludwig-Maximillians Universität München, Germany

Participants
Klaus Jahn, University of Munich, Germany
Roman Schniepp, Ludwig-Maximillians Universität München, Germany
Max Wuehr, Ludwig-Maximilians-University Munich, Germany
Winfried Ilg, Hertie Institute for Clinical Brain Research, Germany

S.8 ***Gamification to invoke behavioural changes. New challenges for rehabilitation in the daily living environment***

Chair
Edouard Auvinet, MSKLAB, Imperial College, London, UK

Participants
Nina Skjæret-Maroni, Norwegian University of Science and Technology, Norway
Claudine Lamoth, University of Groningen, The Netherlands
Dag Svanæs, Norwegian University of Science and Technology, Norway

S.9 ***Muscle synergy analysis: a promising tool for diagnosis and evaluation of balance and gait control deficits in people with neurological disorders.***
Chair
Digna de Kam, Radboud University Medical Center, Netherlands

Participants
Digna de Kam, Radboud University Medical Center, Netherlands
Andrew Sawers, University of Illinois, United States
Jessica Allen, Emory University, United States
Katherine Steele, University of Washington, United States

13:00 **Excursions**

Thursday, June 29, 2017

08:30 - 10:30 **Oral Sessions 9 – 12**

O.9 Parkinson's disease *location: Rio Vista*

Co-Chairs:
Martina Manicini, Oregon Health and Science University, United States
Jeffrey Hausdorff, Tel Aviv Sourasky Medical Center

O.9.1 ***Progression of dopa-resistant gait impairment in early Parkinson's disease***
Brook Galna, Newcastle University, United Kingdom

O.9.2 ***Impaired perception of gait asymmetry during split-belt walking in patients with Parkinson's disease with and without freezing of gait***
Esther Bekkers, KU Leuven, Belgium

O.9.3 ***Visual exploration during gait in Parkinson's disease: response to visual cues***
Samuel Stuart, Newcastle University, United Kingdom

O.9.4 ***Accuracy of commercially available activity monitors in people with Parkinson's disease***
Sandra Brauer, University of Queensland, Australia

O.9.5 ***Maximum step length test as an objective marker of motor disease symptom severity in Parkinson disease***
Martijn Muller, University of Michigan, United States

O.9.6 ***Dynamic stability limits during walking turns in Parkinson's disease***
David Conradsson, Karolinska Institutet, Sweden

O.9.7 ***Peripheral Neuropathy Contributes to Impaired Gait in Parkinson's Disease***
Mélanie Beaulieu, University of Michigan, United States

O.9.8 ***Increased Gait Asymmetry During Single and Dual Task Walking Predicts One-Year Conversion to Freezing of Gait in Patients with Parkinson's Disease***
Nicholas D'Cruz, KU Leuven, Belgium

08:30 - 10:30 **O.10 Tools and methods for posture and gait analysis** *location: Oceanside II*

Co-Chairs:
Sjoerd Bruijn, Vrije Universiteit Amsterdam, Netherlands
Geoffrey Wright, Temple University, United States

O.10.1 ***Age-Related differences in compensatory stepping thresholds following unexpected balance loss.***
Itshak Melzer, Ben-Gurion University, Israel

O.10.2 ***Gait adaptation to conflictive visual flow in virtual environments***
Desiderio Cano Porras, Sheba Medical Center, Israel

O.10.3 ***Experimental vs. model-based comparison of stepping threshold in response to external force-controlled perturbation.***
Marie-Laure Mille, ISM - UMR 7287, CNRS & Univ AMU, France

O.10.4 ***Minimal Number of Strides for Reliable Estimation of Temporal Gait Parameters - Implementation of a Novel Algorithm on the Phase Coordination Index***
Meir Plotnik, Sheba Medical Center, Israel

O.10.5 ***Local Dynamic Gait Stability in Parkinsonism***
Peter Fino, Oregon Health and Science University, United States

O.10.6 ***Fractional stability of human gait: Towards a unified concept of gait stability***
Espen AF Ihlen, Norwegian University of Science and Technology, Norway

O.10.7 ***Validation of foot placement locations and step lengths on the Interactive Walkway***
D.J. Geerse, MOVE Research Institute Amsterdam, Netherlands

O.10.8 ***Estimation of gait temporal and spatial parameters in individuals post-stroke by inertial sensors: first steps of the validation process***
Noémie DUCLOS, Université de Montréal, Center for Interdisciplinary Research in Rehabilitation, Canada

08:30 - 10:30 **O.11 Coordination of posture and gait** *location: Las Olas I-III*

Co-Chairs:
Rebecca Reed-Jones, University of Prince Edward Island, Canada
Michael Cinelli, Wilfried Laurier University, Canada

O.11.1 ***When two become one: on spontaneous pattern formation in side-by-side and hand-in-hand walking***
Melvyn Roerdink, Research Institute MOVE, VU University Amsterdam, Netherlands

O.11.2 ***Upper body motion provides additional unique information about gait in people with Parkinson's disease***
Christopher Buckley, University of Sheffield, United Kingdom

O.11.3 ***Stepping to a target in a novel balance environment***
Zrinka Potocanac, Jozef Stefan Institute, Slovenia

O.11.4 ***Intersegmental coordination during walking on gradients***
Arthur Dewolf, Université catholique de Louvain, Belgium

O.11.5 ***Shoulder muscle activity acts to dampen, not drive arm swing motion when altering upper limb mass characteristics***
Michael MacLellan, Louisiana State University, United States

O.11.6 ***Rhythmic wrist movements facilitate lower limb rhythmogenesis and the soleus H-reflex***
Dmitry Zhvansky, Institute for Information Transmission Problems of the Russian Academy of Sciences, Russia

O.11.7 ***Head orientation and stabilisation strategies across age, tasks and optic flow conditions: dynamic stimuli improve head stabilisation even in old age***
Catherine Agathos, Essilor International, France

O.11.8 ***Dynamic multisegmental postural control in patients with chronic non-specific low back pain: A cross-sectional study***
Eling de Bruin, IBWS ETH, Switzerland

08:30 - 09:30

O.12 Cognitive impairment *location: Las Olas IV-VI*

Co-Chairs:
Manuel Montero-Odasso, University of Western Ontario, Canada
Stephen Lord, Newcastle University,

O.12.1 ***Discriminating geriatric patients with and without cognitive impairment: What's in someone's gait?***
Lisette Kikkert, University Grenoble Alpes/ University of Groningen, Netherlands

O.12.2 ***Gait disorders in the elderly and du task gait analysis: a new approach for identifying motor phenotypes***
Bernard Auvinet, Rhumatology Unit, France

O.12.3 ***Depression Increases The Risk Of Injurious Falls In Older Individuals With Mild Cognitive Impairment. Results From The Gait & Brain Study***
Frederico Pieruccini-Faria, University of Western Ontario, Canada

O.12.4 ***The impact of the Ronnie Gardner Method on physical performance in people with mild cognitive impairment: A pilot randomized controlled trial***
Ngaire Kerse, University of Auckland, New Zealand

09:30 - 10:30

O.13 Developmental disorders *location: Las Olas IV-VI*

Co-Chairs:
Nicoleta Bugnariu, University of North Texas Health Science Center, United States
Anouk Lamontagne, McGill University, Canada

O.13.1 ***Spinal locomotor output in children with cerebral palsy***
Yury Ivanenko, Fondazione Santa Lucia, Italy

O.13.2 ***Dynamic postural control in typical development, Autism Spectrum Disorder and Developmental Coordination Disorder***
Haylie Miller, University of North Texas Health Science Center, United States

O.13.3 ***The effect of ankle foot orthosis stiffness on the Margins of Stability during gait in Cerebral Palsy***
Pieter Meyns, VU University medical center, Netherlands

O.13.4 ***Postural Control Deficits in Autism Spectrum Disorder: dissociating sensory acuity and sensory integration***
Mihalis Doumas, Queens University Belfast, United Kingdom

DETAILED PROGRAM

10:30 – 12:30 **Poster Session 3 & Exhibitors** (refreshments provided)

12:30 – 13:30 **Lunch & Exhibits**

13:30 – 14:30 **Keynote Presentation** *location: Las Olas Ballroom*
Bill McIlroy, University of Waterloo, Canada
The remarkable control of balance reactions and the associated implications for clinical assessment and rehabilitation
Chair: **Mike Cinelli,** Wilfried Laurier University, Canada

14:30 – 15:00 **Annual General Meeting** (for ISPGR members)

15:00 – 15:30 **Refreshment Break**

15:30 – 17:15 **Symposia 10 – 12**

S.10 ***"Good vibrations" or are they? Is the activation of skin a worthwhile endeavour for wearable devices and interventions?***
Chair
Tim Inglis, University of British Columbia, Canada

Participants
Leah Bent, University of Guelph, Canada
Chris Nester, University of Salford, UK
Paul Zehr, University of Victoria, Canada
Kristen Hollands, University of Salford, UK

S.11 ***Digging into data: What sensor signals from real-world falls can tell us***
Chair
Ngaire Kerse, School of Population Health, University of Auckland, New Zealand

Participants
Jochen Klenk, University of Bologna, Italy
Luca Palmerini, University of Bologna, Italy
Omar Aziz, Simon Fraser University, Canada
Lars Schwickert, Robert Bosch Hospital, Germany

S.12 ***Can electrophysiology enhance our understanding and treatment of gait and posture in ageing and neurodegeneration?***
Chair
Meir Plotnik, Sheba Medical Center, Israel

Participants
Evyatar Arad, Sheba Medical Center, Israel
Jesse V. Jacobs, Liberty Mutual Research Institutue for Safety, UK
Meir Plotnik, Sheba Medical Center, Israel
Simon J.G. Lewis, Sheba Medical Center, Israel

17:15 – 17:45 **Closing Session**

19:00 – 1:00 **Closing Gala Dinner**

– End of 2017 World Congress –

ISPGR AWARDS

Promising Scientist Award Winner

Sjoerd Bruijn, Vrije Universiteit Amsterdam, The Netherlands

How do humans walk without falling?

Stable gait requires control of the body's center of mass in relation to its base of support. The goal is of course to limit, or recover, from small perturbations that occur during every step. Passive walkers may have some stability, but in real-life conditions active muscle control is paramount. Different muscles controlled by different parts of the central nervous system work to adapt the position of the base of support or to de-/accelerate the body center of mass. In this presentation, I will discuss recent research aimed at unraveling how the brain is involved in maintaining a stable gait pattern.

Sjoerd is scheduled to present on Tuesday, June 27 at 2:30pm.

Emerging Scientist Award Winner

Patrick A. Forbes, Erasmus Medical Centre, The Netherlands

Vestibular control

An accurate representation of how we move in the world is essential for motor activities such as balance, walking and navigation. Vestibular signals contribute to this representation by encoding self-motion in gravito-inertial coordinates, providing essential information to control appendicular, axial and extraocular muscles that are crucial for posture and gaze. The nervous system adapts these signals along the neural pathways carrying them, to accommodate the specific demands of the different systems in control. In humans, we can study these adaptations using non-invasive electrical stimulation that evokes an artificial signal of self-motion; however, the neural underpinnings involved in this technique remain relatively unknown. In this talk, I will present recent research aimed at understanding how vestibular signals are modulated across multiple levels of neuromuscular postural control (i.e. limbs, back, neck and eye), and the vestibular afferent responses that tell us how electrical vestibular stimulation generates a sense of motion without any motion.

Patrick is scheduled to present on Wednesday June 28 at 9:30am.

Aftab Patla Innovation Award

The ISPGR Awards Committee will offer two student poster presentation awards in honour of Dr. Aftab Patla. One award will be for basic science and one for clinical science. Recipients will be chosen from a panel of researchers based on several criteria including:

- creativity and originality of research
- clarity of presentation
- level of understanding

The award will be announced at the closing session.

Best Talk and Best Poster Awards

BEST POSTER AWARD FOR POSTDOCTORAL FELLOWS

In addition to the Aftab Patla Innovation Award, awarded to student poster presenters, ISPGR also offers two best poster awards for Postdoctoral Fellows. One award will be for basic science and one for clinical science. Recipients will be chosen from a panel of researchers based on several criteria including:

- creativity and originality of research
- clarity of presentation
- level of understanding

The award will be announced at the closing session.

BEST TALK AWARD BY A TRAINEE

One best talk award will be awarded to a student/ post doc member of ISPGR who presents an oral presentation at the World Congress. Recipients will be chosen from a panel of researchers based on several criteria including:

- creativity and originality of research
- clarity of presentation
- level of understanding

The award will be announced at the closing session.

Travel Awards

ISPGR is pleased to be able to provide 5 trainee members with a $1,000CAD travel award based on merit as selected by the Awards Committee Congratulations to all the winners!

KEYNOTE SPEAKERS

Grégoire Courtine
Swiss Federal Institue of Technology (EPFL), Switzerland

Grégoire Courtine was trained in Mathematics, Physics, and Neurosciences. He received his PhD degree in Experimental Medicine in France in 2003. After obtaining the Chancellor Award during his post-doctoral training at the University of California Los Angeles (UCLA), where he was also associate for the Christopher and Dana Reeve Foundation, he established his own laboratory at the University of Zurich in 2008. He received the Schellenberg Prize for his work in paraplegia and a prestigious fellowship from the European Research Council in 2009. In 2012, he became the International Paraplegic Foundation (IRP) chair in Spinal Cord Repair in the Center for Neuroprosthetics at the Swiss Federal Institute of Technology, Lausanne (EPFL). Over the past 15 years, Grégoire and his team have implemented an unconventional research program with the aim to develop radically new treatment paradigms for spinal cord injury. The results of this research were recognized in various high-profile publications such as Science and Nature journals, and discussed extensively in national and international media. In 2013, he was invited to share his personal and scientific journey at TEDGlobal. In 2014, Grégoire launched his startup, G-Therapeutics, which aims to translate the medical and technological breakthroughs gained over the past 15 years into a treatment to accelerate and augment functional recovery after spinal cord injury.

http://courtine-lab.epfl.ch/

https://www.ted.com/talks/gregoire_courtine_the_paralyzed_rat_that_walked

Locomotor Neuroprosthetics

Over the past decade, we developed a multipronged intervention that restored supraspinal control over leg movements in animal models of spinal cord injury. The intervention acts over two time windows. Immediately, electrochemical neuromodulation of spinal circuits enables motor control of the paralysed legs. In the long term, will-powered training regimens enabled by electrochemical neuromodulation and robotic assistance promote neuroplasticity of residual connections—an extensive rewiring that reestablishes voluntary control of movement. To identify the physiological principles underlying the therapeutic effects of this intervention, we used computational modelling, inactivation techniques and genetic manipulations. We found that our electrochemical neuromodulation therapy enables motor control through the modulation of muscle spindle feedback circuits. This framework steered the design of spatially selective spinal implants that specifically target these circuits to modulate muscle synergies responsible for flexion and extension of the legs. To reproduce the natural activation pattern of these muscle synergies during locomotion, we interfaced the leg motor cortex activity with electrochemical neuromodulation therapies in non-human primates. This wireless brain spinal interface instantly restored robust locomotor movements of a paralyzed leg in a non-human primate model of spinal cord injury. Preliminary clinical studies suggest that these concepts and technologies are directly translatable to therapeutic strategies to augment motor recovery after spinal cord injury in humans.

Susan Whitney
University of Pittsburgh, United States

Susan L. Whitney, PT, PhD, NCS, ATC, FAPTA received her PhD in motor development/ motor learning from the University of Pittsburgh and her professional physical therapy education from Temple University in Philadelphia, PA, USA. Currently, she is a professor in physical therapy in the School of Health and Rehabilitation Sciences within the University of Pittsburgh Department of Physical Therapy. Dr. Whitney has been a neurologic clinical specialist since 2001. She is the Program Director of the Centers for Rehab Services (CRS) Balance and Vestibular Rehabilitation Center at the University of Pittsburgh Medical Center. She has authored or coauthored over 110 articles on Medline and is currently engaged in research related to concussion, instrument development to predict recovery in persons with balance and vestibular disorders, and vibrotactile feedback in persons with balance disorders.

Vestibular rehabilitation: A multidisciplinary collaboration

This session will demonstrate how clinician-scientists can work with experts in technology to improve the human experience with persons with balance and vestibular disorders. A review of instruments that have been developed to provide care and measure the effectiveness of care for persons living with balance and vestibular disorders will be provided. In addition, the effectiveness of vestibular physical therapy will be described.

Steve Collins
Carnegie Mellon University, United States

Steven H. Collins is an Associate Professor of Mechanical Engineering at Carnegie Mellon University, where he directs the Experimental Biomechatronics Laboratory and teaches courses on Design and Biomechatronics. His laboratory develops technology for gait rehabilitation and augmentation, with a focus on speeding and systematizing development using prosthesis and exoskeleton 'emulators'. These versatile hardware systems allow rapid implementation of new ideas, controlled characterization of human response to device functionality, and new approaches to design and prescription involving online adaptation. Another focus is efficient autonomous devices, such as energy-recycling actuators based on electroadhesive clutches and exoskeletons that use no energy yet reduce the metabolic energy cost of human walking. Steve received his B.S. from Cornell University in 2002 and his Ph.D. from the University of Michigan in 2008. He performed postdoctoral research at T.U. Delft. He has published in Science and Nature. He is a member of the scientific board of Dynamic Walking, a recipient of the ASB Young Scientist Award, an ICRA Best Medical Devices Paper winner, and was recently voted Mechanical Engineering Professor of the Year.)

http://biomechatronics.cit.cmu.edu

Designing exoskeletons and prostheses that enhance human performance

Exoskeletons and active prostheses could improve mobility for hundreds of millions of people. However, two serious challenges must first be overcome: we need ways of identifying what a device should do to benefit an individual user, and we need cheap, efficient hardware that can do it. In this talk, we will describe a new approach to the design of assistive devices, based on versatile emulator systems and algorithms that automatically customize assistance. We will discuss exoskeletons that use no energy themselves, yet reduce the energy cost of human walking, and efficient, electroadhesive actuators that could make wearable robots an order of magnitude cheaper and more efficient. Finally, we will consider the implications of these technologies for clinical practice and commercial products.

KEYNOTE SPEAKERS

Alice Nieuwboer
KU Leuven, Belgium

Alice Nieuwboer works as a full professor in the Department of Rehabilitation Sciences at the University of Leuven, teaching physiotherapy students in specialized subjects of neurological rehabilitation and evidence-based physiotherapy. She is head of the Neuromotor Rehabilitation research group and together with her team is working on several research programs which focus on the mechanisms of gait disturbances in Parkinson's disease (PD), including a prospective study on freezing of gait, combining gait and postural analyses with brain imaging. The group was the first to firmly establish the link between freezing of gait and freezing in other effectors of the motor system, and has since then published widely on this issue. Furthermore, Alice's research team is engaged in motor learning-related work, investigating the effectiveness of writing practice and dual task gait training while offering and withdrawing motor feedback. Novel research themes include how non-invasive brain stimulation may boost neuroplasticity and whether brain dysfunction affects posture and gait control differentially in PD. Underlying all these studies is the question how motor dysfunction and recovery are intertwined in neurodegenerative disease and how this interaction imprints on the brain at the neurological systems level.

The enigma of facing impaired basal ganglia for gait control and rehabilitation

In the past 10 years, research in our laboratory has focused on investigating the behavioral and neuronal determinants of walking deficits in Parkinson's disease (PD) and whether these problems can be overcome with neurorehabilitation. The role of the basal ganglia, as providing a stimulus filtering function and as a learning center of automaticity, is very much highlighted in the typical gait disorders of PD. Our work has shown that freezing of gait can be conceptualized as a loss of automatic spatiotemporal control, which culminates in an inability to release an intended motor response. We claim that this problem reflects a wider motor control disturbance, rather than just a gait deficit. We and others have also shown that freezing of gait is behaviorally complex as it is mediated by cognitive and emotional factors as well as by postural instability. At the neurological systems level, we demonstrated that freezing-related dual task performance was associated with decreased functional connectivity within the striatum and between the caudate and superior temporal lobe. Structurally, we found greater alterations in the cortico-striatal network in freezing than in non-freezing cohorts. This brings an interesting paradox to the fore namely that freezers are more impaired in the neural networks through which they can re-acquire motor skills and are less proficient in practice while switching between task demands. As a result, freezers show reduced early adaptation during motor learning and impaired late consolidation of motor memory. Furthermore, the impact of providing intermittent and continuous cues and feedback to restore the walking pattern is different in patients with and without freezing of gait. This points to the future agenda for gait research in PD. We suggest that developing easy-to-use biomarkers which herald the reaching of the freezing milestone in the disease evolution is a critical step forward to instigate timely and individualized training protocols. In addition, we anticipate that rehabilitation technology will play a major role in freezing prevention using wearable sensors to tap the remaining compensatory brain circuits. Future longitudinal studies need to address whether slowing down the severity of gait deficits can be achieved using these methods against the background of basal ganglia neurodegeneration.

William McIlroy
University of Waterloo, Canada

William (Bill) McIlroy is currently the Professor and Chair of the Department of Kinesiology at the University of Waterloo, Ontario, Canada. . He is a Senior Scientist at the Sunnybrook site of the Canadian Partnership for Stroke Recovery and at Toronto Rehabilitation Institute. He completed is PhD in Biophysics and Neuroscience at the University of Guelph in 1991 under the supervision of Dr. John Brooke with a focus on neurophysiological mechanisms underlying modulation of spinal reflexes supporting the control of lower limbs. Between 1992 and 1996 he trained as post-doctoral fellow in the lab of Dr. Brain Maki at the Centre of Studies in Aging at the Sunnybrook Research Institute. Under the guidance of Dr. Maki, he advanced an interest and expertise in the area of balance control. During this time, he met Dr. Sandra Black who motivated a complementary interest in stroke recovery and facilitated the development of his skills in brain imaging. His fundamental research involves advancing understanding of the neuromotor control of human balance and mobility to inform his translational work focused on advancing the assessment and rehabilitation strategies to improve mobility in older adults and those who have had a stroke.

The remarkable control of balance reactions and the associated implications for clinical assessment and rehabilitation.

The challenge and control of maintaining stability in humans can be uniquely influenced by our adaptations related to habitual bipedalism. Achieving effective and efficient stability control arises from a blend of anticipatory control and stimulus-evoked reactions. The latter will be the primary matter of attention for this presentation with specific focus on the remarkable complexity of the control of dynamic reactions to whole body instability. The healthy neuromuscular control of such behavior exhibits a remarkable degree of flexibility that is dependent on a spectrum of sensory inputs (modality and somatotopy) and CNS transformations that result in elegant patterns of effector activity to achieve the essential precision in movement and force needed to regain stability. While such sensorimotor transformations are themselves quite impressive, it the success in the face of the challenge of temporal urgency that truly distinguishes these reactions. This presentation will review current understanding of the underlying neuromotor control of these critical reactions as well as the changes over the life-span. Such understanding has implications for the approaches used to assess reactive control in clinical settings and the training techniques used to improve impaired control. The discussion of clinical assessment and rehabilitation approaches will focus on current approaches as well the potential impact of new techniques and technologies.

Symposium I Monday, June 26, 3:30 - 5:15, *Location: Las Olas I-III*

Balance and gait changes in preclinical stages of neurodegenerative movement disorders - commonalities, specificities, open questions and future steps

Chair **Winfried Ilg Hertie,** Institute for Clinical Brain Research, Tübingen, Germany
Jeffrey M. Hausdorff, Center for the Study of Movement Cognition and Mobility Tel Aviv Sourasky Medical Center, Israel

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Anat Mirelman, Tel Aviv Sourasky Medical Center, Israel

Motor measures in the prodromal and diseased state of Parkinsons disease

BACKGROUND AND AIM: Prodromal motor features in Parkinson's Disease (PD) likely develop gradually, years before diagnosis. A great deal of effort has been devoted to detecting PD symptoms in prodromal states in at risk populations such as those with a family history of PD, subjects with changes in dopamine transporter or hyperechocogenicity, or individuals who carry genetic mutations with known associations to PD. The leucine-rich repeat kinase 2 (LRRK2) is an important genetic determinant of PD. The autosomal dominant G2019S mutation in exon 41 is associated with an increased frequency of PD in Ashkenazi Jews, in whom rates approach as high as 26% in familial and 15% in apparently sporadic PD. The asymptomatic first-degree relatives of Ashkenazi Jewish PD patients who carry the LRRK2 G2019S mutation, of whom about 50% may carry the G2019S mutation, clearly represent a population at increased risk of developing PD, although penetrance is incomplete. Non-motor biological markers (e.g., olfaction, autonomic dysfunction, sleep disorders) have been used to identify early prodromal signs, however, these non-motor features are not yet sufficiently accurate, robust, sensitive, or specific. Because PD is still diagnosed by its motor features, it is reasonable to assume that subtle changes in motor function will be present prior to the appearance of the cardinal motor signs required for diagnosis. **RESULTS**: Carriers appear to have higher gait variability, more arm swing asymmetry and worse axial control than non-carriers. The poorer performance of the LRRK2-G2019S mutation carriers may be consistent with subtle abnormalities in the central gait network as manifested during the challenging conditions, thus demonstrating decreased compensatory reserve. Recently, we started a longitudinal study to explore the predictive value of these measures in early identification of disease. The initial results of this prospective study support the idea that these motor markers may help to identify PD before it is currently diagnosed. **METHODS**: In this talk, we will present the rationale behind exploring motor measures in populations at risk for developing PD as well as evidence from our group and others on potential utility of different motor measures such as gait variability, arm swing and axial rotation as early markers of disease. We include in our studies healthy adults who carry the LRRK2-G2019S mutation and age matched healthy adults with non-known mutations. Assessment are conducted under usual and during challenging conditions such as dual-tasking and fast walking in order to unmask subtle changes in performance. **CONCLUSIONS**: Growing evidence suggests that motor measures can be valuable in identifying subtle changes in individuals at risk for PD and provide valuable information on disease progression and potential disease phenotypes.

Joan O'Keefe, Rush University Medical Center, United States

Potential preclinical gait and balance markers for developing Fragile X- Associated Tremor/ Ataxia Syndrome (FXTAS)

BACKGROUND: Carriers of a "premutation" size 55-200 CGG repeat FMR1 gene expansion are at risk for developing FXTAS, a neurodegenerative disorder marked by cerebellar ataxia, balance deficits, and cognitive impairment. Risk factors for developing FXTAS are not completely understood and early preclinical detection methods are needed. In previous studies we found that premutation (PM) carriers without FXTAS demonstrated

significantly delayed postural reflexes and disrupted sensory weighting for balance control compared to controls. In a smaller cohort we found a trend toward increase double support time in asymptomatic PM carriers which was not different from carriers with FXTAS. Presently we conducted gait and balance "stress" tests including those with a dual task (DT) cognitive interference paradigm which we hypothesized would reveal early motor impairments in asymptomatic PM carriers. Such quantitative measures may be useful in predicting risk for developing FXTAS and characterizing its progression and response to interventions. **METHODS**: PM carriers without FXTAS (n = 14; mean age 62.4 ± 9.4 years), PM carriers with FXTAS (n = 9; mean age 67.1 ± 10.1) and age matched controls (n = 22; mean age 60.0 + 10.8 years) underwent gait and balance testing. Quantitative assessment of gait and turning via a 2 minute walk test and postural control (iSWAY) were performed utilizing an inertial sensor system (APDM; Oregon). Gait analysis was performed during a self-selected pace, fast as possible pace, and DT condition. Stance (feet apart/together), vision (eyes open/closed), surface stability (firm/foam surface), and cognitive demand (ST/DT) were altered to modulate the postural challenge. DT conditions for balance and gait consisted of a simultaneous verbal fluency task. **RESULTS**: PM carriers with and without FXTAS exhibited worse balance on the iSWAY than control subjects, with more difficult conditions (feet together/eyes closed/foam) yielding the most highly significant results ($p = 0.04$ to < 0.0001). During fast paced gait, carriers without FXTAS demonstrated significantly reduced total distance traveled ($p = 0.03$), reduced cadence ($p = 0.04$), and longer turn step time ($p = 0.046$). They also had significantly slower stride velocities than controls during DT walking ($p < 0.0001$) and their DT cost for total distance walked was higher than controls ($p < 0.05$). **CONCLUSIONS**: PM carriers demonstrate worse gait performance at fast paced speeds and under DT conditions and worse balance under environmentally challenging conditions. This suggests that such balance and gait tests using state of the art quantitative measures may be sensitive to produce at risk markers for FXTAS. Identification of preclinical signs of motor impairments in FXTAS will potentially establish an intervention window for providing preventative rehabilitation strategies, disease modifying drugs, and earlier interventions.

Winfried Ilg, Hertie Institute for Clinical Brain Research, Germany

Individual changes in preclinical spinocerebellar ataxia identified via increased complexity of posture and gait tasks

BACKGROUND AND AIM: It has been shown for various neurodegenerative diseases that subtle movement changes might occur many years before clinical manifestation. This notion has not yet been well explored in autosomal-dominant spinocerebellar ataxias (SCAs) This preclinical phase of SCAs attracts increasing research interest as it could provide a promising window for early therapeutic intervention -both pharmaceutical and rehabilitative- before substantial irreversible neurodegeneration has occurred. Effectiveness of future intervention studies will largely depend on three prerequisites: (1) Quantification of motor deficits as early as possible; (2) a more detailed understanding of the earliest dysfunctions in cerebellar control mechanisms; (3) the availability of measures which are able to quantify progression and intervention benefits in this preclinical stage. We hypothesized that complex stance and gait tasks allow to (i) reveal changes in the control of posture and gait already at early stages of the preclinical phase when clinical ataxia signs are still absent, and (ii) to quantify the progression of motor changes in the preclinical phase before disease onset. **METHODS**: We assessed preclinical SCA mutation carriers, SCA patients at early stage and healthy controls by quantitative movement analyses in a cross-sectional study design. We examined stance and gait tasks with increasing complexity to unravel preclinical changes. In detail, we assessed different stance conditions of increasing motor demand: standing still for 30 seconds with feet closed and (i) eyes open, (ii) eyes closed, (iii) eyes closed on a mattress. Additionally, we examined walking conditions of increasing motor demand: straight walking, tandem walking, and tandem walking on a mattress. Motor features were related to the genetically estimated disease onset, and used as input for multi-variate models of movement characterization. **RESULTS**: Body sway in stance and spatio-temporal variability in tandem walking differentiated between preclinical SCA subjects and healthy controls. Complex movement conditions allowed to discriminate even those mutation carriers without any clinical signs

in posture and gait. Multivariate regression analysis categorized preclinical mutation carriers on a single-subject level with 100% accuracy within a range of 10 years to estimated onset. In addition, movement features in stance and gait correlated significantly with genetically estimated time to onset, indicating a gradual increase of motor changes with increasing proximity to disease manifestation. **CONCLUSIONS**: This study provides evidence for quantitative measures of preclinical motor changes in SCA, which allow to discriminate subjects even on a single-subject basis in complex motor tasks and which enable the quantification of preclinical disease progression.

Symposium II Monday, June 26, 3:30 - 5:15, *Location: Las Olas IV-VI*

Using smart technology in the prevention of age-related decline in balance, strength, physical activity and behavioral complexity

Chair: **Jorunn L Helbostad,** Norwegian University of Science and Technology, Norway
Beatrix Vereijken, Norwegian University of Science and Technology, Norway

Michael Schwenk, Robert Bosch Hospital, Germany

Personalized balance and strength activities and physical activity advices integrated in daily life

BACKGROUND AND AIM: The LiFE concept is an intervention with balance and strength activities integrated in daily life, shown to be effective in reducing falls in home-dwelling older adults [1]. The European Project "PreventIT" has adapted the LiFE programme for a younger cohort (aLiFE). aLiFE was developed during several consortium meetings including experts and end users and incorporates challenging strength and balance/ agility tasks, as well as specific principles for increasing physical activity in young-old adults. The aim of this pilot study was to test the feasibility and acceptability of the aLiFE programme in the target population. **METHODS**: A 4-week pre-post test intervention study was conducted in three European cities (Stuttgart, Amsterdam, Trondheim). Included were community dwelling men and women aged 60 to 70 years. The aLiFE programme was delivered by specialist instructors during 4 home visits. Before and after the intervention, participants underwent an assessment of their mobility performance. After the intervention, participants answered a questionnaire/participated in semi-structured interviews to assess their opinions regarding the aLiFE training. Trial registration: ISRCTN37750605. **RESULTS**: Thirty-one subjects were recruited (63.3% female). Participants' mean age was 66.9 ± 2.4 years. One participant dropped out during the intervention period. No severe training-related adverse events occurred. After the intervention, the vast majority of the participants rated aLiFE positive (satisfaction score median: 6.0 points, out of maximum 7). Twenty-four participants (80.0%) rated the programme helpful for improving balance, 27 (90.0%) for improving strength, and 26 (86.7%) for increasing physical activity. Twenty-nine (96.7%) stated that they would recommend aLiFE to a friend. In semi-structured interviews, participants mentioned several positive aspects about the intervention including the aLiFE concept (i.e., option to integrate activities into daily life), aLiFE activities (i.e., adequate task challenge), aLiFE trainer (i.e., option to interact with an instructor for developing a personalized training regimen), fun, and usefulness of the intervention for improving health. Balance performance was significantly improved after the intervention (Community Balance and Mobility Scale Score Baseline: 66.0±12.7, Post assessment: 70.4±13.1; P=0.001). **CONCLUSIONS**: The aLiFE programme was found to be feasible and acceptable in the target population. aLiFE is currently further developed into an electronic version (eLiFE) delivered on smartphone and smartwatch, using motivational strategies to enhance behavioural change. 1. Clemson L, Fiatarone Singh MA, Bundy A, Cumming RG, Manollaras K, O'Loughlin P, Black D. Integration of balance and strength training into daily life activity to reduce rate of falls in older people (the LiFE study): randomised parallel trial. BMJ. 2012;345:e4547.

Anisoara Ionescu, Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland

Complexity in behavior in older age. What does it tell us?

This presentation will address the main theoretical and practical considerations necessary for definition of complexity of physical behavior as a outcome measure: (1) existing evidence; (2) definition of temporal patterns according to various sensor configurations and multimodal data; (3) appropriate tools to quantify the meaningful information embedded in the temporal patterns.

Elizabeth Boulton, University of Manchester, UK

How to adopt health-related behaviour in older age.

BACKGROUND AND AIM: The health and wellbeing benefits of engaging in physical activity (PA), and of improving strength and balance, are well documented. The World Health Organisation's recommendations of 150 minutes per week of moderate intensity physical activity have been adopted across the world in policy and practice promoting PA. However, the number of older adults engaging in this level of PA remains low. **METHODS**: The European Project "PreventIT" (Grant Agreement No. 689238) has adapted the Lifestyle-integrated Functional Exercise (LiFE) programme, which reduced falls in people 75 years and over (BMJ 2012; 345:e4547), for a younger cohort (aLiFE). The aLiFE programme incorporates challenging strength and balance/ agility tasks, as well as specific recommendations for increasing physical activity in young-older adults, aged 60-70 years. Personalised advice is given on how to integrate strength, balance and physical activities into daily life, in a way which should not be time consuming. aLiFE has been further developed to be delivered using smartphones and smartwatches (eLiFE), providing the opportunity to send timely motivational messages and real-time feedback to the user. Both aLiFE and eLiFE are behaviour change interventions, supporting older adults to form long term physical activity habits. PreventIT has taken the original LiFE concept and further developed the behaviour change elements, explicitly relating them to Social Cognitive Theory, habit formation theory and behaviour change techniques. **RESULTS**: The motivational elements of aLiFE and eLiFE have been mapped to Social Cognitive Theory and Behaviour Change Techniques (BCTs). Goal setting, planning, prompts and real-time feedback are used to deliver a person-centred experience for participants in the intervention. Over 1,200 motivational messages have been written, based on, and mapped to, psychological theory, using established BCTs and evidence regarding the importance of strength, balance and PA. These messages have been translated into three languages, with a sub-set back translated to English to ensure fidelity. Findings from the aLiFE and eLiFE pilot studies have been used to further refine the PreventIT motivational strategy, to ensure acceptability to this target group. A motivational assessment tool has been developed to enable us to investigate stated motivational drivers with actual performed behaviour within the feasibility RCT. **CONCLUSIONS**: Mobile technology such as smartphones and smartwatches can be used effectively to monitor behaviour and to deliver a personalised intervention. The PreventIT mHealth intervention focusses on behaviour change from initiation to long-term maintenance, addressing the different phases of adopting a healthier lifestyle. As such, it makes a strong contribution to the developing field of evidence-based mHealth.

Sabato Mellone, University of Bologna, Italy

Self-assessment by use of smart technology

BACKGROUND AND AIM: Billion people worldwide are users of mobile phones. With the new generation of older people, the technology is and will increasingly become a necessary part of older people's life. Smartwatches or wristbands have so far become most popular in the younger generation. The field of mobile technologies expands at a high speed. The advent of smartphones and smartwatches has created potential for both collecting and delivering time and context-sensitive health information, thus penetrating significantly into society. Both smartphones and smartwatches are examples of relatively cheap, unobtrusive and persuasive technology. They comprise various physiological and inertial sensors, transmission modules and processing capabilities, making them suitable for continuous all-day/anyplace health, mental and activity

status monitoring. **METHODS**: Sensors embedded in smart phones and smartwatches are suitable as platforms for assessment of mobility, balance, and physical function. Development of self-assessment test batteries based on sensors in smartphones and smartwatches will be presented and discussed. This also includes use of virtual coaching functions for empowering and motivating people in need of guidance and care, and of real-time feedbacks on correct movements during testing. **RESULTS**: Recent developments in mHealth, the delivery of health care services via mobile communication devices, increase the availability of health services and make them cheaper. mHealth developments also support moving responsibility and control from the health care system to empower older people themselves. Especially when people are not yet in the risk phase, or not yet identified as 'patients', such tools can provide very powerful support for the avoidance or reduction of health risks. So far assessment tools based on these technologies have mostly been developed to be used by health care personnel. **CONCLUSIONS**: Smartness of the system relies on the capacity to take decisions and performs actions on the basis of the available data. Smart solutions must support the changing role of users to help them move from a rather passive, to have the ultimate control and at the same time enhancing their responsibility over their own health through sensors that detect and report back information on their daily living activities and actual functional level.

Symposium III Monday, June 26, 3:30 - 5:15, *Location: Oceanside II*

Noninvasive brain stimulation: a research and rehabilitative tool for gait and postural control.

Chair: **Talia Herman,** Tel Aviv University, Israel

Brad Manor, Institite for Aging Research, Harvard Medical School, United States

Modulating prefrontal brain activity to enhance dual task gait and posture in older adults

When standing or walking, we often perform additional cognitive tasks such as talking, reading or decision making. This "dual tasking" is critical to the safe and successful completion of activities of daily living. However, dual-tasking often results in reduced performance in one or both tasks, especially in older adults and in those with age-related disease. The observation that dual tasking comes at a "cost" to performance means that the involved tasks depend at least in part upon shared brain networks. Strategies designed to increase brain network excitability and/or efficiency thus hold great promise to improve dual task capacity across the lifespan. Transcranial direct current stimulation (tDCS) is one safe and non-invasive method that uses low-level electrical currents to temporarily and selectively change brain excitability. I will begin this talk with a description of a series of studies examining the immediate effects of 20-minute sessions of tDCS designed to facilitate the excitability of the left dorsolateral prefrontal cortex (dlPFC)--a brain region closely involved in higher level cognitive executive function--on dual task costs and other metrics of postural control and gait in relatively healthy younger and older adults. I will then present the results of a recent pilot randomized controlled trial testing the longer-term effects of a 10-session tDCS intervention targeting the dlPFC on dual tasking, clinical measures of physical and cognitive function, and fMRI-derived measures of brain function, in older adults with concomitant motor and cognitive deficits. Finally, I will present the results of a study designed to establish the effects of tDCS on the brain's responsiveness to walking-related sensory stimuli, in order to highlight a potential mechanism through which tDCS might facilitate the control of posture and gait in different environmental and/or task conditions.

Moria Dagan, Tel Aviv University, Israel

The short-term effects of modulating brain excitability on freezing of gait in Parkinson's disease: A pilot study using transcranial direct current stimulation (tDCS)

BACKGROUND AND AIM: Freezing of gait (FOG) is one of the most disturbing and least understood symptoms of Parkinson's disease (PD). The utility of parkinsonian medications is limited for FOG and it frequently becomes dopamine resistant. Although consensus does not yet exist, there is strong evidence that FOG results from disturbances within cortical areas of the brain linked to motor function (i.e., the primary motor cortex, M1) and executive function (i.e., the dorsolateral prefrontal cortex, DLPFC). Noninvasive modulation of neuronal excitability via transcranial direct current stimulation (tDCS) imparts beneficial behavioral changes when applied separately to these brain areas. This study examined the effects of tDCS simultaneously targeting both M1 (leg region) and the DLPFC on FOG and its mediators in PD. **METHODS**: Individuals with diagnosed PD and self-reported FOG completed assessments of FOG, gait and cognition before and immediately after 20 minutes of tDCS designed to facilitate the excitability of M1, M1+left DLPFC, or neither (i.e., sham). All participants received each tDCS condition on separate visits; condition order was double blinded. The primary outcome was performance on a FOG-provoking test, with scores ranging from 0 to 45 (most severe). Secondary outcomes included the Timed Up and Go (TUG) test of mobility and the Stroop test of executive function. We also quantified spatiotemporal gait parameters during usual walking and while performing a serial subtraction dual-task. **RESULTS**: Data were analyzed from 17 subjects (age 69±6 years; disease duration 8±5 years; UPDRS-III 41±15; FOG-Questionnaire 21±5; Mean±SD). tDCS targeting the M1+left DLPFC improved scores on the FOG-provoking test (from 11.8±10.8 to 8.1±7.7; $p<0.05$), the TUG (from 18.0±17.7 to 16.5±19.4 seconds; $p=0.03$) and the Stroop test (from 28.2±12.7 to 32.4±14.4; $p=0.002$). Conversely, performance in these tests was not affected by tDCS targeting M1 only or sham stimulation ($p>0.09$). Additionally, the mean and variability of several spatiotemporal gait features (e.g., stride length, gait speed, swing time) derived from usual walking trials improved ($n=10$; $p<0.05$) only after M1+left DLPFC stimulation. tDCS did not appear to influence these gait features in the dual-task condition. **CONCLUSIONS**: Our results indicate that simultaneous modulation of motor and cognitive brain areas may reduce the severity of FOG and its mediators in older adults with PD. This support the notion that prefrontal executive circuits play a key role in the mechanism of FOG. The finding that tDCS did not influence dual-task performance suggests that the encumbrance of dual tasking cannot be alleviated by a single session of stimulation in this population. Future studies are thus needed to 1) elucidate the tDCS-induced neurophysiological alterations that led to the immediate reduction in FOG severity, and 2) establish the duration of effects for both single- and multiple-session tDCS interventions.

Manuel Montero-Odasso, Western University, Canada

TMS as a potential intervention to enhance mobility and cognition

A significant portion of aging disabilities arise from two major syndromes: cognitive and mobility impairments. Clinically, these syndromes have been evaluated and treated as separate entities, creating gaps and obscuring common connections. Cognition and mobility declines have been linked to specific brain changes. Clinical studies shows that falls are doubled in the cognitively impaired, and that having slowing mobility predict cognitive decline and dementia. A common factor in both disorders is executive dysfunction that seems to be an early phenomenon in the pathway to mobility and cognitive disability. Non-invasive brain stimulation (NIBS) is a safe approach to modulate the excitability of brain cortical areas. Repetitive application of a magnetic field, that is, repetitive transcranial magnetic stimulation (rTMS), to the cortex results in enhancement or inhibition of cortical excitability depending on the frequency or strength of the field applied. Therefore, rTMS has a potential as an intervention to improve cognition and mobility performance, in older adults with executive dysfunction. This talk will review the principle and mechanism of rTMS and the potential effect on executive dysfunction and present our preliminary results of a proof-of-principle study targeting older adults with executive dysfunction to improve gait performance and cognition with (rTMS). We are testing the efficacy of rTMS to improve gait stability and variability, in forty older adults (>65 years) with executive dysfunction. We will evaluate if observed

changes in gait and mobility are mediated by executive function enhancements and mood changes. rTMS can modify and enhance cognitive-mobility interaction in the short term after one session (via changes in cortical excitability) and in the long term (via neuroplastic changes) with repeated sessions. We postulate that enhancing some aspect of cognition can prevent mobility decline and reduce risk of falls.

Symposium IV Tuesday, June 27, 3:30 - 5:15, *Location: Oceanside II*

(E)motion: The effect of emotion on human posture and gait control in health and illness

Chair: **John Stins,** Vrije Universiteit, Netherlands

Brad Fawver, University of Utah, United States

Emotional influences on postural control and gait behavior in healthy young adults

It is widely accepted that emotional states can influence the efficiency and effectiveness of motor performance. A growing body of work has sought to characterize how discrete emotions that induce unique motivational orientations and/or psychophysiological response patterns differentially impact the execution of goal-directed behaviors. This presentation will provide an overview of the empirical evidence in this area, and I will discuss contemporary theoretical perspectives supported by the extant findings. Emphasis will be placed on how motivational orientations, and subsequent alterations in motor planning and control processes, affect postural and gait responses. The influence of emotionality on motor behavior is traditionally investigated by eliciting affective states using exogenous (or externally generated) stimuli, such as emotional pictures, or through endogenous (or self-generated) methods. Using these approaches in healthy young adult populations, we have quantified the impact of emotion on motor performance within a variety of whole-body movement paradigms (e.g., gait initiation). These experimental tasks implicitly regulate distance from emotional stimuli, allowing more appropriate measurement of underlying approach-avoidance motivations and straightforward testing of existing theoretical frameworks. During these protocols, kinetic and kinematic measures provide a reliable index of individuals' ability to plan their actions, react to movement onset cues, and control motor output. This work has significant implications for the improvement of gait dysfunction in groups with psychological conditions (e.g., anxiety/stress disorders, fear of falling) or motor diseases (e.g., Parkinson's). Moreover, the hope is that continued research in this area will facilitate the development of efficacious strategies that help individuals up- or down-regulate motor output to meet performance demands and adapt to environmental/situational constraints. I will briefly highlight some of these applications and provide a foundation for further discussion by other presenters in this symposium.

Mihalis Doumas, Queens University, Canada

Influence of social evaluative threat during a mathematical anxiety task on standing balance

BACKGROUND AND AIM: The postural control system is able to produce adaptive responses when environmental conditions change. For example, when standing on an elevated surface similar to standing at the edge of a building, a reduction in postural sway and increased ankle stiffness is observed (e.g. Carpenter et al. 2001). This response has been attributed to the fear and anxiety induced by the elevated surface. However, little is known about whether this response is an elevated-surface-specific (or task-specific) mechanism or a general threat-related mechanism that can also be induced by cognitively-induced anxiety and threat. The aim of the present study was to assess threat-related adaptive changes in postural sway using mathematical anxiety and social evaluative threat, both of which have been shown to induce a high stress response. **METHODS**: Thirteen young adults (age range 19-26 years, 9 female) participated in the study. Participants were asked to perform a simple arithmetic task, comprising additions of pairs of one- two- and three-digit numbers appearing on a screen. After establishing a baseline level of performance in the arithmetic (seated) and the balance

tasks (standing on a sway referenced surface), the experiment's three main blocks commenced. In block 1, participants performed the arithmetic task while standing. In block 2 (mathematical anxiety), they performed the same task but a progress bar appeared across the screen in each trial. The progress bar comprised a green part followed by a red part. The duration of the red part of the progress bar was 70% of participants' mean reaction time in the previous block, but they were told that it was the average reaction time in their age group, in order to increase anxiety levels. After the end of block 2 the participant was told that his/her performance was poor relative to other participants tested and that he/she had to try harder. Then block 3 commenced. Stress was evaluated in the end of each block using self-report. **RESULTS**: Self-reported stress linearly increased up to block 3 (social evaluative threat) confirming that our stress manipulation was successful. Reaction times were significantly faster when the progress bar was introduced and became significantly slower when the social evaluative threat was added. Postural sway amplitude and standard deviation in the anterior-posterior direction decreased as stress increased. **CONCLUSIONS**: Our results suggest that the adaptive postural responses observed under conditions of threat may not be limited to posture-related threat but may also generalize to high threat and stress induced in non-posture-related contexts. Future research comparing different types of threat would be useful in evaluating the common characteristics of this adaptive postural response.

Laura Avanzino, University of Genoa, Italy

Effect of emotion on gait in Parkinson disease

BACKGROUND AND AIM: Gait dysfunction is one of the most disabling motor symptoms of Parkinson's disease (PD). Freezing of gait (FOG) is a symptom that affects over 50% of patients and increasing evidence suggests that non-motor systems (i.e., limbic cortico-basal ganglia-cortical circuits) might be involved in its underlying mechanisms. Indeed, it has been showed that the autonomic nervous system might be activated during FOG with an increase in heart rate due to stress or increased anxiety. Recently, by directly comparing FOG episodes in anxious and non-anxious situations it has been showed that that anxiety is an important mechanism underlying FOG. The aim of the present research is to provide direct evidence about the involvement of the limbic basal ganglia circuit in FOG pathophysiology. To this aim, we evaluated the impact of emotional stimuli on gait initiation in patients with PD, with and without FOG. **METHODS**. Thirty-six participants, divided into three groups (12 PD patients with FOG, 12 PD patients without FOG and 12 controls) stood on a sensorized mat and were asked to take a step forward when a pleasant image appeared on a screen placed in front of them and a step backward in response to an unpleasant image (congruent task) or to take a step backward when a pleasant image appeared on the screen and a step forward in response to an unpleasant image (incongruent task). The experiments were made in two separate days and the order was randomized. Reaction time and step size were recorded by means of a sensorized mat (GaitRite). **RESULTS**: In PD patients with FOG, gait initiation was influenced by emotion-inducing stimuli. Indeed, in PD patients with FOG, for steps forward, the reaction time was longer and the step size was shorter than in the other groups only in the incongruent task (i.e., to take a step forward in response to an unpleasant image). **CONCLUSIONS**: The results confirmed that negative emotions exert an influence on motor control. In PD patients with FOG the valence of emotional stimuli influenced not only step preparation (reaction time), but also step execution (step size) supporting the theory on the role of the non-motor systems (e.g., limbic system) in the pathophysiological mechanisms of FOG. FOG is likely to be caused by a complex interplay between motor, cognitive and affective factors, rather than being a pure motor problem. These results offer speculations to novel therapeutic approach.

Jeffrey Staab, MOVE Research Institute, Netherlands

Clinical applications of a model of threat assessment, posture, and gait control

BACKGROUND AND AIM: Descriptions of patients who experienced problematic interactions between anxiety and posture and gait control date back at least 150 years. Many of these reports identified clinical features that are quite recognizable in the modern era. Over the last 20-30 years, research conducted by investigators around the world has identified several mechanisms that link threat assessment to control of locomotion in

normal individuals and patients with vestibular and balance disorders. **METHODS**: Key studies linking state anxiety, trait anxiety, and anxiety disorders to posture and gait control, vestibular symptoms, and balance disorders were identified. Studies included normal individuals and patients with various vestibular and balance disorders who were investigated with psychological assessments, physiologic measures, and brain imaging techniques. **RESULTS**: Research findings supported development of an integrated model linking threat assessment processes in the brain to control of posture and gait in health and disease. Four major mechanisms are contained in the model: (1) trait anxiety as a risk factor for alterations in posture and gait control, (2) bottom-up stiffening of stance and gait in response to postural threat in normal individuals and patients with vestibular and balance disorders (3) excessive visual dependence in patients with persistent dizziness after acute vestibular events, and (4) alterations in brain activity and connectivity suggesting reduced cortical modulation of hyperactive vestibular responses to space-motion stimuli in patients with chronic dizziness. **CONCLUSIONS**: A model containing four major mechanisms linking threat assessment and locomotion provides a framework for understanding the effects of anxiety on posture and gait control.

Symposium V Tuesday, June 27, 3:30 - 5:15, *Location: Las Olas IV-VI*

Implementation research in balance, mobility and fall prevention: How do we move the evidence into action?

Chair: **Kathryn Sibley,** University of Manitoba, Canada

Kathryn Sibley, University of Manitoba, Canada

Using Implementation Theories, Models and Frameworks to Move Posture and Gait Research in to Action: An Example Using Balance Assessment in Physiotherapy Practice

BACKGROUND AND AIM Theoretically-informed implementation is increasingly endorsed to advance this evolving field away from "an expensive version of trial-and-error" toward insights in which the mechanisms of implementation are more likely to succeed. Proponents argue that the use of theories, models and frameworks in designing implementation interventions provides generalizable approaches for developing research questions and interventions and allow for an incremental accumulation of knowledge. However, explicit use of implementation theory for balance and mobility research, and rehabilitation research more broadly, has historically been low. The objective of this presentation is to describe one prominent implementation process framework ¬-the Knowledge-to-Action (KTA) framework - and how it has been applied to research on balance assessment in physiotherapy practice. **METHODS**. The KTA Framework, a meta-framework that combines the critical features of over 30 planned-action theories, is also a pragmatic model that provides step-by-step direction for implementation. The KTA framework's 2-pronged approach (the knowledge creation phase and action cycle) guided research questions to identify knowledge-to-practice gaps and barriers and facilitators to knowledge use; synthesize primary research results; and develop, implement and evaluate interventions to increase knowledge use. **RESULTS**. The KTA- guided studies have explored current trends in balance assessment and factors influencing practice across Canada, the synthesis of theoretical content underlying validated measures of balance, and the development, monitoring and evaluation of a tailored behavior change intervention to increase reactive balance measurement among physiotherapists that targeted identified barriers and facilitators to reactive balance assessment. Results showed the rate at which therapists used standardized balance measures was less than optimal and identified both knowledge-to-practice gaps and individual and organizational barriers to implementing best assessment practices. These findings highlighted the need for synthesis of evidence on potential measurement solutions to address those gaps prior to the development of corresponding intervention strategies. Synthesis results along with identified barriers and facilitators to practice were used to select a measure and behavior change techniques to test in a multi-site behavior change study. Discussion. The comprehensive KTA framework was useful in guiding the direction of this ongoing research program. Of note: the sequence of the individual KTA steps was modified to improve the efficiency of

intervention development, there was a need to go back and forth between the 2 phases of the KTA framework, and additional behavior change theories were consulted. Continued research is needed to explicitly evaluate the efficacy of applying KT theory to best practice in health care.

Stephen Lord, Neuroscience Research Australia, Australia

Translation of Fall Prevention Research into Policy and Practice: the Australian Experience

This presentation will discuss fall prevention implementation initiatives undertaken in Australia that have built on posture and gait research evidence. Three examples of implementation into policy and practice will be presented. The first relates to the development and validation of the QuickScreen fall risk assessment tool, a simple assessment now used by over 1000 clinicians across Australia. Key features of the successful clinical translation have been the low cost of the assessment tool, the dissemination of its utility to fall prevention networks, the provision of training for the administration of the tool and the liaison with policy makers to facilitate its wide availability. – The second describes the systematic roll out of the Stepping on exercise intervention for fall prevention (1). In collaboration with an Australian State Health Department, Stepping On has been made widely available to older people living within New South Wales. Importantly, this roll out has been staged to allow for a stepped wedge evaluation of the program's effectiveness. – The final example is the implementation of systematic review evidence of effective components of exercise interventions for fall prevention (2) into exercise guidelines, and the promulgation of community exercise programs that incorporate evidence-based formats via a well-resourced website (www.activeandhealthy.nsw.gov.au). The above and other initiates have been facilitated by the participation of researchers in the drafting of evidence-based fall prevention guidelines, the establishment of state-based fall prevention networks and the Australian and New Zealand Falls Prevention Society. Potential barriers to continued implementation include the lack of core, ongoing funding for translational initiates, loss of corporate knowledge in research and policy sectors and withdrawal of funding support due to government policy changes and priorities. References 1. Clemson L et al. J Am Geriatr Soc 2004;52:1487-94. 2. Sherrington C et al. J Am Geriatr Soc 2008;56:2234-43.

Debra Rose, California State University, United States

Translating Fall Risk Reduction Knowledge into Action: A U.S. Perspective

BACKGROUND AND AIM: The use of conceptual frameworks to guide the development, implementation, and sustainability of fall risk reduction programs is rarely applied or clearly articulated in the fall research literature. The focus of this presentation will be to discuss the extent to which current fall prevention program initiatives in the United States have been successful in translating fall prevention knowledge into action and the criteria used to evaluate whether a fall prevention program is considered to be evidence-based and subsequently recommended for widespread adoption by community-based agencies. **METHODS**: Findings from the FallsFree® Initiative will be used to illustrate key concepts of the KTA framework and identify gaps and current challenges to building a successful fall prevention infrastructure in the USA. **RESULTS**: A large gap continues to exist between research and practice - many interventions evaluated in controlled research settings are rarely evaluated in real-world settings, may only address one dimension of a complex multidimensional phenomenon, or are inadequately disseminated and translated to ensure broader uptake among "more typical older adult" groups and across different organizational infrastructures. **CONCLUSIONS**: Recommendations include the development of assessment tools and programs that are based on theoretical frameworks, address the multifactorial nature of falls, are amenable to modification, and integrate behavior change strategies aimed at promoting long-term adherence to engaging in fall protective behaviors. Examples of intervention programs, not limited to the area of fall risk reduction that can serve as a model for guiding successful knowledge translation into action research will also be discussed.

Chris Todd, University of Manchester, UK

Bridging the implementation gap in activity promotion using behaviour change techniques implemented using novel technologies.

Engaging older people in exercise to prevent falls has for some time been recognized as problematic. Our early work demonstrated that older people were not motivated by fall prevention but rather that activity promotion should be aimed at maintenance of independence (Don't mention the F-Word). Subsequent work explored psychosocial drivers of uptake and adherence and the role of trainers and class composition. What becomes clear is we need strong psychological theoretic models which predict behaviour and help us shape interventions to change behaviour. We then need ways to deliver these interventions on a routine basis at scale. Recent technological developments provide the opportunity to deliver such interventions to older people in real time. Two contrasting examples of recent work will be presented. In the first example, ProFouND uses ICT to help in the delivery of cascade training of Otago exercise. Here technology is a facilitator of traditional face to face exercise training. In the second example PreventIT uses ICT, smartphones and wearables to deliver an activity programme using the Health Action Process Approach and Behaviour Change Taxonomy to design the motivational programme delivered via the technology. We reflect on the challenges involved in these two examples in terms of the two gaps in translation: the first gap between basic science and applied products and ideas; the second gap between products and ideas and implementation in clinical practice.

Symposium VI Tuesday, June 27, 3:30 - 5:15, *Location: Las Olas III*

Peeking inside the brain - How to study the neural control of walking?

Chair: Vivian Weerdesteyn, Radboud University Medical Centre, Netherlands

Brett Fling, Colorado State University, United States

Locomotion in the scanner: Understanding how you move by imaging your brain while you don't

Although diagnostic assessment via clinical magnetic resonance imaging (MRI) has been in use for decades, only recently have advanced MR techniques been utilized in the research setting to investigate neural mechanisms underlying gait and balance control, to identify biomarkers for disease progression, and to assess therapeutic intervention efficacy. Functional MRI (fMRI) has been used extensively in a variety of stimulus-response paradigms to identify regions of task-specific neural activity. More recently, functional connectivity MRI (fcMRI) has revealed that the brain is very active even in the absence of explicit input or output. That is to say, spontaneous fluctuations in neural activity is not random noise, but is specifically organized in the resting human brain and serves as a potentially important and revealing manifestation of spontaneous neuronal activity providing insight into the intrinsic functional architecture and topography of the brain and potential physiological correlates of disease and mobility impairment. Finally, emerging literature is making use of diffusion weighted imaging within the MR environment to identify associations between white matter microstructural integrity and locomotor control. Diffusion imaging measures the diffusion or movement of water molecules within the brain. White matter demonstrates a high degree of diffusion parallel to the axons, with limited diffusion along orthogonal directions, reflecting the structural integrity of white matter and allowing indirect assessments of myelination and axonal density. Combining functional MR approaches with diffusion imaging allows for a comprehensive assessment of neural structure and function. While exciting advances have been made, the study of gait and balance with MR-based methods is clearly hampered by the inability to actually stand and/or move within the MRI environment, which would allow recording brain activity evoked by actual locomotion. To address this limitation, several approaches have been developed to provide indirect evidence of supraspinal involvement in locomotion. These approaches have identified brain activity patterns during imagined actions such as standing, walking, and running, as well as neural activity while actually performing voluntary or passive lower limb movements inside the scanner. The latter studies have incorporated diverse levels of complexity from the evaluation of isolated, unilateral, and repetitive ankle

and knee movements to more complex tasks that require coordinated movements of multiple joints reflective of stepping or pedaling actions. This talk will provide insight into the structural and functional brain circuitry that underlie locomotor control identified via MR-based methodologies. In addition, I will discuss recent work detailing structural and functional neural mechanisms that are, at least in part, responsible for impairments in locomotor control that accompany healthy aging and select neurologic populations.

Noel Keijsers, Sint Maastenskliniek, Netherlands

Shedding light on neural control of gait

In the nineties, the first experiments of measuring brain activity during motor control using functional near-infrared spectroscopy (fNIRS) were conducted. FNIRS is a non-invasive neuroimaging technique, which indirectly detects cortical activation by measuring hemodynamic changes. In the last decades, fNIRS has also been used to study the neural control of gait. This talk will focus on the possibilities of examining the neural control of gait in healthy controls and patients during normal and complex gait using fNIRS. Despite the increased use of fNIRS as a neuroimaging technique, there are still several issues to be resolved. The most important pitfalls using fNIRS during gait are positioning of the optodes, spatial resolution, inter-subject variability of the hemodynamic response, systemic interferences, limited penetration depth and absorption of the light by the hair. We will demonstrate that the spatial resolution of fNIRS is defined by the ability to distinguish between two closely located area's such as the motor cortex for hand and foot. Furthermore, the advantage of other neuroimaging techniques (TMS, MRI) to optimize the location of fNIRS optodes will be evaluated. Systemic interference removal techniques will also be discussed, and tips and tricks from our own experience will be presented to optimize fNIRS experiments. Several studies have been performed to study the neural control of walking using fNIRS. Miyai and colleagues [1] were the first to demonstrate significantly increased oxygenated hemoglobin levels in supplementary motor (SMA), primary motor (M1) and somatosensory area (S1), indicating involvement of these cortical areas during gait. Interestingly, this increase in oxygenated hemoglobin was mainly seen prior to and at the start of gait. During precision stepping we showed an increased activity in the prefrontal cortex [2], which was also found in other studies focusing on gait under challenging conditions. The activation patterns in the cortical area of motor cortex are more inconsistent among the studies, which is most likely caused by differences in methodology and analysis methods. The last part of this presentation will focus on the use of fNIRS in patients with gait problems and evaluation of cortical recovery during gait rehabilitation. So far, pre and post gait training studies measuring cortical activity using fNIRS are scarce. Miyai showed in a small number of 8 stroke patients that asymmetry in sensorimotor cortex reduced during gait rehabilitation [3]. In conclusion, fNIRS has shown its applicability in studying the neural control of gait in healthy subjects and patients. However, we should be careful with the interpretation of the current available literature since systemic interferences removal techniques have not always been used. FNIRS seems the neuroimaging technique best applicable in a practical manner. [1] Miyai, Neuroimage 2001;[2] Koenraadt, Neuromimage 2014;[3] Miyai, Stroke 2003

Dan Ferris, University of Michigan, United States

Using EEG to study your brain on the run (or walk)

BACKGROUND AND AIM: The number of research studies using scalp electroencephalography (EEG) to record electrocortical signals during walking and running has greatly increased over the last six years. This is largely due to advances in EEG hardware and signal processing algorithms. Using new EEG systems, analysis software, and approaches to source localization within the brain, EEG can now provide unprecedented insight into brain function during human walking and running. **METHODS**: We combine high-density active EEG electrodes with Independent Component Analysis (ICA) and inverse head models of electrical propagation within the head to isolate and filter muscle, eye, and motion artifacts. By studying walking and running under different conditions of motor and cognitive tasks, we can determine when and which brain areas are synchronized to body movement and/or mental calculations. We have validated our approach using an electrical head phantom mounted on a robotic motion platform to determine how well we can determine the ground truth of brain

electrical activity. **RESULTS**: My laboratory has published many studies over the last six years examining how electrocortical activity changes to different experimental conditions. I will summarize results from some of the studies and end with a discussion on the limitations of using EEG during human locomotion. **CONCLUSIONS**: EEG provides a reliable and innovative means to assess brain activity related to the control of human locomotion but great care needs to be given to preventing non-brain sources from interfering with analysis of electrocortical activity.

Symposium VII Wednesday, June 27, 11:00 - 1:00, *Location: Las Olas I-III*

Vestibular and cerebellar control of posture and gait - Neurophysiology and Clinical Applications

Chair: Roman Schniepp, Ludwig-Maximillians Universitat Munchen, Germany

Klaus Jahn, Schoen Klinik, Germany

Supraspinal control of posture and gait: Cerebello-vestibular aspects

BACKGROUND AND AIM: The network for supraspinal control of posture and gait in humans has been elucidated over the last years. This network includes premotor frontal cortex for task planning and initiation, basal ganglia for motor and the thalamus for sensory modulation, the homologues to the pacemakers for gait pattern and speed regulation in the interfastigial cerebellum and bilateral midbrain tegmentum (cerebellar and mesencephalic locomotor regions; pedunculopontine nucleus), as well as their descending target regions in the pontine reticular formation. The cerebellum and the vestibular systems – both closely related to each other – belong to the most crucial parts of this network, in particular during locomotor tasks, different from undisturbed steady state locomotion. The cerebello-vestibular network is also crucial for postural stability and the prevention of falls. **METHODS**: This talk will summarize the basic sensorimotor control principles of supraspinal locomotor centers, based on imaging approaches in PET and MRI techniques. Special interest will be placed for the discussion of alterations of supraspinal vestibular feedback loops in the context of aging and in patients with different forms of sensory deficits. Moreover, task specific cerebellar locomotor control principles will be presented based on fMRI and PET findings that are translated to neurophysiological findings during stance and gait. A model of cerebellar integration of vestibular signals into the locomotor and oculomotor system will be outlined and discussed. **RESULTS**: Steady state locomotion as well as more demanding locomotor tasks preferentially involves the brainstem and cerebellar network. Any change in activity requires premotor cortical activity. Postural tasks and slow locomotion use multimodal sensory input (via thalamus and cerebellum). Further, as soon as the task involves spatial orientation aspects, the hippocampal formation and the parietal cortex become active. As shown by different approaches, spatial orientation and navigation also depends on vestibular signals. Patients with complete loss of vestibular afferent input do have deficits in finding places. **CONCLUSIONS**: The cerebellum serves (1) as a pacemaker for rhythmic locomotor activity: patients with cerebellar dysfunction walk with high variability; and (2) as an integrator of sensory functions into postural control during stance and gait. The vestibular signals, synchronized to the step cycle, enter the brain network via the cerebellum and together with vision and somatosensation adapt the gait pattern to different environments. Together, the cerebello-vestibular circuits build widely distributed connections to networks involved in balance control, navigation, and even in cognition.

Roman Schniepp, Ludwig-Maximillians Universitat Munchen, Germany

Vestibular and cerebellar locomotion control? from basic principles to clinical and scientific implementations

BACKGROUND AND AIM: Human upright gait is controlled by vestibular and cerebellar locomotor control schemes. Disturbances in both systems lead to gait ataxia with the result of an impaired everyday mobility and a higher risk for falls. This presentation will emphasize the current agenda of basic principles of vestibular and cerebellar gait control as well as the technical opportunities to quantify these. Moreover, a discussion on the opportunities for clinical and scientific implementations will be stimulated. **METHODS**: The presentation will focus on five different aspects: (I) Neurophysiological findings will be reviewed and basic control principles of vestibular and cerebellar gait control will be extracted. (II) The influence of vestibular and cerebellar dysfunction on fall risk will be highlighted retrieved by findings in epidemiological studies. (III) The association of central and peripheral vestibular dysfunctioning on sociopsychological features and on gait performance will be discussed (cross sectional study in 600 patients with vertigo and dizziness). (IV) Preliminary results of a longitudinal study on the relationship between gait performance, posturography measurements, off-laboratory mobility measurements and fall risk in 340 patients with vertigo and dizziness will be presented. **RESULTS**: (I) An increase of movement pattern variability is the hallmark of gait ataxia in patients with vestibular and cerebellar disorders. It reflects the quality of coordinated movements and is thus linked to dynamic instability. (II) Dynamic instability depends on the walking speed in the context of a speed-dependent specification of vestibular signal integration into the locomotion network. (III) Increased levels of gait variability are linked to a higher risk of falls in patients with vestibular or cerebellar disorders, also in a speed dependent manner. (IV) Neuro-otologic functions are not correlated to increased fall risk. (V) Psychometric disorders, such as dizziness-related anxiety and depression mainly influence walking pace variables, but not dynamic instability. (VI) Off-laboratory measurements indicate typical, but not specific patterns of mobility alterations in both patient groups. These alterations have no additional value for the fall risk estimation. **CONCLUSIONS**: Vestibular and cerebellar locomotor control schemes are important for maintaining dynamic balance during walking. Dysfunctions of both systems are associated to a higher risk for falls. The vestibular and cerebellar systems interact for the control of dynamic stability. The critical sites appear to be midline cerebellar structures (flocculus/ paraflocculus) and the anterior parts of the cerebellar hemispheres. Gait variability reflects the stability of the gait pattern and serves as quantitative marker for the quality of dynamic balance and for limb coordination. It is related to increased risk for falls in patients with cerebellar and vestibular disorders.

Max Wuhr, Ludwig-Maximillians Universitat Munchen, Germany

New paradigms of vestibular stimulation to enhance impaired balance control in patients with vestibular dysfunction

BACKGROUND AND AIM: There is increasing evidence that information processing in a variety of sensory systems can be enhanced by adding an imperceptible amount of noise to the system. The rationale behind the phenomenon is a mechanism known as stochastic resonance (SR) wherein the response of a nonlinear system to input signals can be optimized by the presence of a particular non-zero level of noise. This presentation will give an overview on recent studies that examined the beneficial effects of noise-enhanced vestibular function on impaired balance control in patients with vestibular dysfunction. **METHODS**: Examination of the effects of an imperceptible white noise galvanic vestibular stimulation (nGVS) on vestibular perceptual and reflex thresholds as well as balance control during standing and walking in patients with vestibular dysfunction. **RESULTS**: nGVS effectively lowers vestibular perceptual thresholds and facilitates vestibular reflex responses to weak input stimuli thereby indicating the presence of SR-like dynamics in the human vestibular system. Application of nGVS in patients with vestibular dysfunction leads to an improvement in objective and subjective balance during standing and walking. **DISCUSSION**: Decrements in vestibular function due to aging or disease severely affect balance, orientation, and visual fixation abilities of afflicted individuals. Currently the therapeutic regimen in patients with bilateral vestibular dysfunction is limited to physical therapy. Within this context, noisy vestibular

stimulation might provide an alternative future approach to reduce postural imbalance and the incidence of falls in this population.

Winfried Ilg, Eberharnd-Karls Universitat Tubingen, Germany

Motor Training in Degenerative Spinocerebellar Disease: Ataxia-Specific Improvements in posture and gait by coordinative physiotherapy and exergames

BACKGROUND AND AIM: The cerebellum is known to be essentially involved in gait and posture control and plays a critical role in motor learning. Despite increasing evidence that intensive motor training can be beneficial also for patients suffering from with degenerative cerebellar disease, it remains not yet fully understood under which constraints patients with degenerative cerebellar disease do profit. It also remains unclear by which mechanisms these patients might improve and, moreover, to which extent the improved control capabilities like dynamic balance transfer to movements which have not been explicitly included in the training schedule. In this talk we discuss the state of the art and present evidence from different training studies in patients with degenerative spinocerebellar disease. These studies demonstrate that coordinative training based either on physiotherapy or on exergames can lead to a significant benefit in patients with degenerative ataxia, even patients with advanced neurodegeneration. Effects were assessed by clinical rating scales, a goal attainment score for achievements in activities of daily life, and quantitative movement analysis of posture and gait. **METHODS**: The focus of the methodical description will be on quantitative movement approaches for the identification of training-induced improvements in ataxia-specific control capabilities like dynamic balance and intra-limb coordination in complex movement sequences. The goal of such approaches is to reveal whether transfer of improved motor skills to other movements is possible despite underlying progressive cerebellar disease. **RESULTS**: As an example, we present a quantitative analysis of rapid goal-directed stepping sequences while playing a commercial exergame version of a choice stepping reaction time task called "Light Race". Following the exergames intervention, cerebellar subjects show not only an increased step frequency and decreased movement variability, but also improved inter-joint coordination and dynamic stability. This demonstrates changes in control capabilities specifically dysfunctional in cerebellar disease. These improvements correlated with changes in gait and goal-directed leg placement outside the game play. In addition, we will present data of a currently ongoing study assessing the effects of exergame training in preclinical ataxia subjects (mutation carriers of autosomal-dominant spinocerebellar ataxias before the clinical manifestation of ataxia). **CONCLUSIONS**: These studies deliver evidence that - despite progressive cerebellar damage - subjects with degenerative cerebellar disease are still capable to improve complex movement sequences, taking advantage of long-term training. Improvements transfer also to other movements, indicating a generalization effect of the underlying control capabilities.

Symposium VIII Wednesday, June 28, 11:00 - 1:00, *Location: Las Olas IV-VI*

Gamification to invoke behavioural changes. New challenges for rehabilitation in the daily living environment

Chair: **Edouard Auvinet,** Imperial College, London, UK

Nina Skjæret Maroni, Department of Neuroscience, NTNU, Trondheim, Norway,

Exergaming in exercise and rehabilitation: The past, the present, and the future

In the 1970s and 80s video game arcades became a popular after school activity, gathering children of all ages to play video games using vigorous body movements. In the beginning of the 21th century, however, computer-based videogames became a sedentary living room activity, and considered one of the contributors to increased childhood obesity. With the promotion of the Playstation-based Dance Dance Revolution (DDR) videogames as a weight loss tool in 2004, videogames have again become a means to get up and move. These

movement-controlled videogames were quickly recognized as a potential tool to provide enjoyable, easy access, low threshold exercise. Today, exercise-based videogames, so-called exergames, are used extensively in exercise and rehabilitation settings. The current presentation illustrates the many advantages exergames hold over more traditional exercise regimes. Not only can exergames be fun and social activities, they also hold the potential to be function-specific, and can provide an exercise environment with changing game-contexts that can include a variety of different tasks and different difficulty levels. The technology also holds the potential to provide real-time feedback on the exercises by providing for instance a game score, and to automatically adapt difficulty level. Several studies and reviews the last couple of years have found that older adults can benefit from a videogame-based exercise program to improve balance and postural stability, and confidence with functional activities, as well as improvements in physical and cognitive fall risk factors. However, with the continued release of new technology, the field is constantly evolving, giving rise to several research challenges to establish good guidelines for use of this technology as an exercise and rehabilitation tool across ages and diseases. The presentation will put focus on some of the guidelines proposed to be used both in the design of exergames and for usage in clinical practice. The presentation concludes with the ongoing developments of game technology using mobile platforms that can make exergames become more implemented in everyday life activities. This ubiquitous gaming integrates the player's physical location into a game world, and offers new potential for unsupervised exercise and rehabilitation of functional activities in a real-life situation. This new technology might also make trained motor skills more transferable to daily life situations than those acquired by traditional screen-based exergames.

Claudine Lamoth, University of Groningen, Netherlands

Gamification to invoke behavioural changes. New techniques for home-based functional training

The application of game elements in a non-game context, so-called gamification offers new potential for unsupervised rehabilitation of functional activities in a real-life situation. For instance, using augmented reality (AR) techniques, it is possible to provide therapy in a real world scenario that has been augmented with virtual gaming elements. In addition mobile exergames that run on smartphones might stimulates the player to move through an environment and provide feedback that enhances physical activity. In the present presentation I will introduce two on-going projects, which use gamification principles for home-based functional training. The first project is about the development of an Adaptive Trainer using Augmented Reality Gaming for Exercise Therapy (ATARGET). The main theme of ATARGET is rehabilitation from stroke, being one of the major causes of upper limb impairment. Following a stroke, patients suffer from a loss of range of motion, impaired force generation, chronic pain, and disordered movement coordination. These symptoms limit physical, social, and economical independence. Rehabilitation should start as early as possible and include the elements of high intensity and frequency, task-oriented functional training and personalization. A viable approach to provide the above therapeutic elements and to make the treatment accessible at home is to apply gamification principles to the training. In ATARGET a game is designed for stroke patients to improve upper limb motor function and motivation for training by making adaptive game changes, while playing; implemented using artificial intelligence based software. During therapy the patients interact with a real living environment via augmented reality glasses, created by combining 3D display a motion capture techniques, traceable physical objects. Game difficulty is adjusted by online analysis of the subject's movements After discharge to home from rehabilitation after hip surgery frail older adult often stay sedentary. For this geriatric group no specific exercise interventions exist. Using gaming principles, daily activities like making coffee, are stimulated and behavioural changes are invoked. The focus is on facilitating functional movements and activities. First semi-structured interviews were performed from design principles were developed. During co-creation sessions the general principles of the game application were tested and adjusted. Individual goals are set and embedded in a game environment using a tablet, an accelerometer and a step counter. Feedback was provided about goal achievements. A group of healthy older and a group of older adults who had hip surgery and was discharged to home used the intervention for six-weeks. Goal Attainment Scaling was used to evaluate the six-week home intervention.

Dag Svanæs, Department of Computer and Information Science, NTNU, Throndeim, Norway

Adding a Layer of Magic: Behavioural Change through Gamification of Patients´ Everyday Living Environment

BACKGROUND AND AIM: Exergames are progressively used to increase physical activity and improve health and physical function in older adults, both in rehabilitation settings and as home-based exercise. Most current exergames use motion capture techniques (e.g. Kinect) or hand-held devices (e.g. Nintendo Wii) for input, and a large display (e.g. TV) for output. Although large positive effects have been achieved with exergames running on such hardware platforms, they pose certain limitations on what exercises can be done, in what place and in what circumstances. Display-based exergame platforms require that the patient constantly faces the display, making it hard to design for exercises that require rotation or bending of the body. In addition, the platforms require that you play the game in one particular part of your living environment, and that gameplay is the main activity while playing. **METHODS**: These limitations have motivated our search for technology platforms that (1) do not require the patient to constantly face a display, (2) can be played in a number of different places in the patient´s living environment, and (3) can be played concurrently with everyday activities. **RESULTS**: One approach to achieve these goals is to gamify the patient´s living environment through interactive internet-of-things technology. This can be done through a network of wireless distributed sensors such as active areas on the walls and in the floor, and output through light, movement and sound in the environment. Simple games, such as following a sound around the apartment, or walking the stairs to get points, can be implemented on such platforms. An inspiration for such games is the magical environments found in fairy-tales and fantasy movies. We will present some early examples of such pervasive "magical" exergames, and our first attempt at a set of design guidelines for this class of exercise games. We will further argue for the necessity of a user-centred design process for these games, with a high degree of patient and therapist involvement, and show how existing best-practice in interaction design can be utilized for this purpose. The latter includes a focus on the lived human body and its relation to its environment, inspired by the phenomenology of the French philosopher Merleau-Ponty and the ecological psychology of J. J. Gibson, respectively. We will end by presenting a research agenda for this class of exergames, both from a game design and from a medical perspective. **CONCLUSIONS**: Pervasive gaming platforms utilizing current internet-of-things technology has the potential to overcome some of the limitations on current exergames posed by display-based gaming platforms. The successful design of such games requires a user-centred design process and a focus on the human body and its relation to its environment.

Symposium IX Wednesday, June 28, 11:00 - 1:00, *Location: Oceanside II*

Muscle synergy analysis: a promising tool for diagnosis and evaluation of balance and gait control deficits in people with neurological disorders.

Chair: **Digna de Kam,** Radboud University Medical Center, Netherlands

Digna de Kam, Radboud University Medical Center, Netherlands

Deficient motor modules on the paretic side result in direction-specific instability after stroke.

BACKGROUND AND AIM: Postural instability is a risk factor for falls in people after stroke. Defective muscle coordination of balance recovery responses may contribute to their greater fall risk. We investigated the association between postural response coordination deficits and perturbation-induced body sway in stroke survivors. **METHODS**: Ten people after unilateral stroke (> 6 months) and 9 healthy controls were subjected to translational balance perturbations in 12 directions resulting in a feet-in-place balance correcting response. Activity of eight muscles was recorded bilaterally: erector spinae (ERSP), gluteus medius (GLUT), biceps femoris (BFEM), semitendinosis (SEMT), soleus (SOL), rectus femoris (RFEM), peroneus (PER) and tibialis anterior (TA). We extracted muscle synergies for each leg using nonnegative matrix factorization on the initial EMG activity

(3 consecutive 75 ms time bins) following the platform's motion. We also determined perturbation-induced body sway using a single-link inverted pendulum model. We used a repeated measures general linear model to compare the activation of muscle synergies that we identified in patients and controls, in order to pinpoint abnormal directional tuning of postural responses in stroke survivors. Finally, we performed regression analyses to characterize the correlation between body sway and stroke-related deficits in the activation of motor modules. **RESULTS**: While three muscle synergies (W1-W3) were consistently found in healthy controls, some of these muscle synergies were either absent or abnormally activated in patients' paretic legs. Specifically, muscle synergy W3 (BFEM, SEMT, ERSP), which responded to forward perturbations, was missing in 4 out of 10 paretic legs. Consequently, forward perturbations induced larger body sway in individuals without W3 than those with it ($p=0.02$). Another deficit in patients' paretic legs was the abnormally low initial activity of W2 (TA, PER, RFEM), which responded to posterolateral perturbations ($p<0.05$). Accordingly, the lower initial W2 activity was strongly associated with increased body sway following posterolateral perturbations ($R^2=0.68$, $p<0.01$). Lastly, the stroke-related deficits in muscle coordination were heterogeneously distributed across patients, indicating that stroke survivors suffer from distinct deficiencies in their muscle coordination. **CONCLUSIONS**: We identified stroke-related deficits in muscle coordination of postural responses that each resulted in a pattern of direction-specific postural instability. The heterogeneous distribution of these deficits across patients suggests that different pathophysiological mechanisms may underlie each of the deficits. The structural deficits in paretic W3 hint at greater cortical involvement for this muscle synergy. In addition, identifying patient-specific postural control deficits is crucial for the development of targeted interventions to improve postural stability in stroke survivors.

Andrew Sawers, University of Illinois, United States

Neuromuscular determinants of slip-induced falls in older adults

BACKGROUND AND AIM: A central question relevant to the prevention of falls is: what distinguishes situations when we recover our balance from those that we do not? Specifically, how does the robust neuromuscular control of walking and balance break down during a fall? Previous work has focused on muscle coordination during successful balance recoveries, or the mechanics of falls. Here, for the first time, we identify differences in muscle coordination between falls and recoveries. **METHODS**: We extracted muscle synergies, groups of spatially fixed co-active muscles, and identified onset latencies and peak activity from a set of bilateral leg EMG recordings taken from 15 community-living older adults who fell (71 ± 2 yr, 13 women) and 13 who recovered (71 ± 5 yr, 5 women) after an unexpected mechanically induced slip while walking. Gait-related variables at slip onset (i.e. speed, stability) and slip parameters (i.e. peak velocity, distance) were also calculated. The number of muscle synergies, gait related variables, and slip parameters were compared between slip outcomes with 1-sided t-tests. Differences in onset latencies and peak activity were tested with separate MANOVAs. **RESULTS**: During slip trials, subjects who fell recruited fewer muscle synergies (3.7 ± 0.9, range: 3-6) than those who recovered (4.7 ± 0.9, range: 4-6, $p < 0.01$), suggesting a smaller motor repertoire with which to respond to the slip and prevent a fall. While no differences in peak muscle activity were found, subjects who fell had delayed knee flexor (fallers: 170 ± 61 ms; non-fallers: 120 ± 16 ms, $p < 0.01$) and extensor (fallers: 239 ± 43 ms; non-fallers: 186 ± 41 ms, $p < 0.01$) onset latencies in the slip/leading leg compared to subjects that recovered. Additionally, differences in the composition and recruitment of muscle synergies containing knee muscles were observed between slip outcomes, suggesting that coordination of muscle activity around the knee may be critical to avoiding falls from slips. Subjects who fell during the slip trial recruited a unique 'all-on' muscle synergy characterized by extensive co-activity across all (bilateral) muscles. Several features of this synergy (i.e. first trial response, extensive flexor-extensor co-activation) suggest that it may reflect motor output consistent with a startle response. If so, this would imply that the startle response disrupts rather than preserves stability. Finally, slip parameters and gait-related variables at slip onset did not differ between slip outcomes. Thus, these differences in muscle coordination may reflect differences in neuromuscular control of movement rather than biomechanical constraints imposed by the perturbation or initial gait mechanics. **CONCLUSIONS**: These results are the first step in determining the causation of falls from the perspective of muscle coordination. They suggest

that there may be a neuromuscular basis for falls that could provide new insights into their treatment and prevention.

Jessica Allen, Emory University, United States

Recruiting common muscle synergies across gait and balance behaviors is associated with better motor performance in neurologically impaired populations

BACKGROUND AND AIM: Muscle synergy analysis related to mobility in clinical populations commonly focuses on walking behaviors. Although a higher number of muscle synergies has been associated with walking speed post-stroke, large differences in gait speed are observed in individuals with identical number of synergies for walking. Similarly, many individuals with Parkinson's disease (PD) have walking deficits yet no reduction in synergy number. Whereas maintaining balance is critical for mobility, little is known about muscle synergies for balance in either population. While neurotypical adults recruit common muscle synergies across balance and walking, we hypothesized that muscle synergies for walking and balance would be differently affected in neurological disorders, resulting in fewer common muscle synergies recruited across behaviors. Here, we tested whether the number of common muscle synergies recruited in walking and reactive balance is related to motor performance cross-sectionally in individuals post-stroke and longitudinally in individuals with PD before and after rehabilitation. **METHODS**: Muscle synergies were found using nonnegative matrix factorization from electromyography recorded while walking at preferred speed and during standing reactive balance in two cohorts: a cross-sectional cohort of 5 chronic stroke survivors (2 female, 58.4 ± 10.6 years, 4 right-side hemiparesis), and a longitudinal cohort of 6 individuals with PD (5 male, 64.0 ± 16.6 years old) before and after a dance-based rehabilitation intervention. The number of muscle synergies recruited during each behavior was chosen such that the overall variability accounted for was greater than 90%. The number of muscle synergies common to both behaviors was identified using Pearson's correlations. **RESULTS**: In both stroke and PD, better motor performance was associated a larger number of muscle synergies common to walking and reactive balance. In the stroke cohort, three paretic leg muscle synergies during walking were identified across all participants despite a wide range of walking speeds (0.3 to 1.4 m/s). In contrast, the number of walking muscle synergies also recruited during reactive balance ranged from 0 to 2, resulting in a moderate positive relationship (R^2=0.49) with walking speed. Similarly, improved motor performance after rehabilitation in the PD cohort was not associated with increases in muscle synergy number. Instead, improved motor performance was associated with an increase in common muscle synergies across walking and reactive balance. **CONCLUSIONS**: We provide initial evidence that the ability to recruit common muscle synergies across walking and balance is related to motor performance across different neurological disorders. Therefore, examining how muscles are coordinated across multiple behaviors may have important implications for rehabilitation interventions aimed at improving muscle coordination deficits causing reduced mobility.

Katherine Steele, University of Washington, United States

Walk-DMC: Dynamic motor control predicts function and treatment outcomes in children with cerebral palsy

BACKGROUND AND AIM: New tools are needed to characterize the impact of neurologic injury on movement and function. Every brain injury is unique, which makes optimizing treatment and improving movement a challenging endeavor for clinicians and patients. The aim of this research was to evaluate whether muscle synergy analysis could be used as a tool to better characterize impaired motor control after neurologic injury, specifically for children with cerebral palsy (CP). An advantage of synergy analysis is that it relies on electromyography (EMG) data, which is already collected as standard of care for many children with CP. We hypothesized that children with synergies more similar to typically-developing (TD) peers would demonstrate less functional impairments and have better outcomes after treatment compared to children with more impaired synergies. **METHODS**: We analyzed EMG data during walking for children with CP who previously received gait analysis at Gillette Children's Specialty Healthcare, as well as a group of TD peers who serve as

the control database for the lab. Synergies were calculated using nonnegative matrix factorization for up to five muscles on the leg (rectus femoris, medial hamstrings, lateral hamstrings, anterior tibialis, gastrocnemius). For each child, we calculated the Walking Dynamic Motor Control Index (Walk-DMC), a summary measure of synergy complexity that gives a z-score of the variance accounted for by one synergy compared to TD peers. A Walk-DMC of 100 indicates synergy complexity similar to TD peers, while each 10 point decrement indicates a one standard deviation reduction in synergy complexity compared to TD peers. We analyzed synergies for 633 children with CP and compared Walk-DMC to functional impairment and selective motor control. For 473 children with multiple gait analyses, we further analyzed whether Walk-DMC was correlated to changes in gait after conservative treatment, orthopaedic surgery, or selective dorsal rhizotomy. **RESULTS**: Children with CP used less complex synergies during gait compared to TD peers, with an average Walk-DMC of 86.2. Walk-DMC decreased significantly with increasing functional impairment, as measured by the Gross Motor Functional Classification System (GMFCS). Children in GMFCS Level I (least impairment) had an average Walk-DMC of 92.4, as compared to 79.2 for children in GMFCS Level IV. Walk-DMC was significantly correlated with clinical exam measures of selective motor control (r=0.44). Children with a greater Walk-DMC were also more likely to have positive improvements in gait after treatment, regardless of treatment group. In a forward stepwise regression analysis, Walk-DMC was significantly correlated with post-treatment Gait Deviation Index, walking speed, and scores on the Pediatric Outcomes Data Collection Instrument Sports & Physical Fitness Scale. **CONCLUSIONS**: Dynamic motor control is related to functional impairment and treatment outcomes for children with CP.

Symposium X Thursday, June 29, 3:30 - 5:15, *Location: Las Olas I-III*

"Good vibrations" or are they? Is the activation of skin a worthwhile endeavour for wearable devices and interventions?

Chair: Tim Inglis, University of British Columbia, Canada

Leah Bent, University of Guelph, Canada

How cutaneous mechanoreceptors in the foot are able to contribute to functional movement

There are four subclasses of mechanoreceptors in the skin, each able to provide unique information regarding input from the environment or internal movement relating to slip, pressure, vibration and stretch (Macefield, 2005). Much of what we know regarding these receptors has been realized through investigations into afferent firing in the hand in both human (Johansson et al 1982) and in primate (Suresh et al 2016) studies. Our work has focused on the skin on the foot dorsum and sole to better understand how this sensory source can contribute exteroceptive and proprioceptive information for balance and gait. Using the technique of microneurography we recorded from single afferent fibres innervating skin across different regions of the foot dorsum and sole. Through these means we can assess how individual subclasses respond to specific inputs; including different vibration frequencies and stretch, as well as identify now variables such as hardness and thickness of the skin may alter the afferent firing properties (Strzalkowski et al 2015). We explore how both receptor density and dermal mechanical properties may influence the known difference in afferent response across foot sole locations. Our results indicate that, while the range of frequencies are similar to the hand, subclasses of receptors are not as easily targeted in the foot. Additionally, there is an effect of skin mechanics on afferent threshold. These findings will both have implications on future work looking to isolate and activate specific types of skin receptor through vibration. Many clinical applications use sensory perception as a marker of skin function. The ability to perceive a cutaneous input is dependent on afferent threshold, receptor density and central contributions. However, perception is just part of the equation when it comes to skin contributions to functional tasks. We must also consider the potential for afferents to effect changes on the motor system. In particular, the ability to alter the excitability of the motor neuron pool to specific muscle groups. Cutaneous input has the ability to provide meaningful input to the spinal cord regarding slips and contact with obstacles. These rapid reflexes, evoked from activation of skin on the foot, are seen in both the lower limbs and upper

limbs (Fallon et al 2005, Bent Lowrey 2013). Ultimately, the implications of the mechanistic work here is the ability to apply this knowledge to further understand how to activate these mechanoreceptors in situations of reduced input. It is known that the aging process adversely affects the sensitivity of mechanoreceptors in the feet (Peters et al 2016). Applications to mitigate these effects have been explored through augmentation of skin input via specialized shoe insoles (Lipsitz et al 2015, Perry et al 2008). Knowing HOW these subclasses of mechanoreceptors respond to artificial and natural input is fundamental in order to push forward the field of sensory rehabilitation.

Christopher Nester, University of Salford, UK

Cutaneous implications of orthotics and footwear use

Many believe the application of load to the human foot is well understood the distribution of plantar load during walking is well documented (1), and we know how orthoses and footwear change the distribution (2). However, there is good reason to be sceptical as we seek to understand these loads as "sensory inputs" and thereafter manipulate them. At each point of plantar contact compression and shear loads are applied but the latter are extremely challenging to measure (3). The effects of these forces are interrelated too. For example, tensile forces may stretch the skin and in doing so increase its compression stiffness, thus changing the load transfer between external device and foot. This interaction has never been studied. Furthermore, the spatial orientation of the plantar force sensors is often unclear, since shoe soles are not flat and flex constantly during walking. Plus, feet move relative to shoes and thus sensors. This is further complicated when foot orthoses create complex contours at the foot/load interface. This can mean forces measured normal to the sensor surface are actually shear loads applied to the foot but compression forces applied to the skin (e.g. in the sides of a heel cup). Compared to plantar loading, far less is understood about dorsal loading and here too only in compression forces (4). The lower loads on these surfaces might have specific advantages, such as an improved ability for footwear materials to slide across the skin surface and thus provide shear sensory input. Also, since different dermatomes are affected, this could be a location for additional input when plantar sensation is affected in isolation. A further feature of how external devices affect plantar load and sensory input is application of load to otherwise non weight areas, such as the medial arch (2), or alterations in the timing of loading, such as under the forefoot in elevated heels (5). How these sensory inputs combine with mechanical effects (changes in joint moments) and non-cutaneous sensory inputs (e.g. receptors in joint capsules) is not understood. We do know, however, that muscles change in response to the mechanical and sensory perturbations created by footwear (6) and orthoses (7), but the precise function of sensory input compared to mechanical inputs is not clear. Finally, there are now means to modulate loads applied to the skin surface in new ways, using vibration or textures for example (12, 13). There are thus new opportunities for modifying sensory input and we believe movement control but only a weak scientific basis upon which to make progress. 1. McClymont J et al R Soc Open Sci. 2016 Aug 17;3(8):160369. 2. Chapman GJ, et al. Gait Posture. 2013 Jul;38(3):443-9. 3. Rajala S et Clin Biomech (Bristol, Avon). 2014 May;29(5):475-83. 4. Hagen M et al. Res Sports Med. 2010 Jul;18(3):176-87. 5. Luximon Y. Hum Mov Sci. 2015 Jun;41:307-19. 6. Forghany S. Gait Posture. 2014 Jan;39(1):205-12. 7. Murley GS et al. Clin Bio

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Paul Zehr, University of Victoria, Canada

Cutaneous sensation from the top and bottom of the foot influences locomotor control from nose to toes

The integral role of afferent feedback in the control of rhythmic motor output has been well documented in recent decades. Work in quadrupeds and humans has illustrated that information from proprioceptors is required for finely coordinated locomotion and that specific feedback from cutaneous mechanoreceptors strongly influences gait parameters. Cutaneous feedback from the plantar surface of the foot is an important contributor to the rehabilitation of locomotion after neurotrauma and sensation from the foot dorsum is crucial to the stumbling corrective reaction. Stimulation of cutaneous nerves innervating the foot during stance and swing result in functionally relevant, phase- and nerve-dependent neuromechanical changes in kinematics,

kinetics and ongoing muscle activity of walking all across the body. Work focusing on stimulation of discrete skin regions of the plantar and dorsal surfaces of the foot has revealed that neuromechanical responses are also topographically organized. Feedback from discrete skin regions of the feet contribute to 'sensory steering', which has implications in rehabilitation and athletic training.

Kristen Hollands, University of Salford, UK

"Good vibrations" or are they? Is the activation of skin a worthwhile endeavour for wearable devices and interventions?

Although it is well-established that the control of balance and gait relies on multiple sensory inputs the role of sensation from the skin on the soles of the foot has received relatively little attention. Recent advances in recording techniques (e.g. microneurography) have allowed insight into how these mechanoreceptors function but very few studies have applied this knowledge to understand the role of these sensors in controlling gait and posture. In particular, we have a very limited understanding of the role of foot skin sensation in the recovery of balance and gait in patient populations with neurologic conditions. This talk will examine the most recent evidence from clinical and biomechanical studies of neurologic patient groups for the role of skin sensation from the feet to contribute to rehabilitation and recovery of balance and gait. After brain injury as many as 34-85% of people experience reduced, lost or exaggerated sensation of touch on the skin (somatosensation) [1]. Some studies have identified that the presence of somatosensory impairments following brain injury are detrimental to balance and the likelihood of regaining independent mobility [2]. Deficits in somatosensation may therefore be an underling factor in the high incidences of falls experienced by people with brain injury [3]. Studies of foot skin sensation and its relationship to balance performance have been conducted in stroke survivors [4] and healthy older adults [5]. These studies show, arguably, limited correlations between foot skin sensation and standing balance control. However, other studies show opportunity for foot skin sensation to contribute to the ability to alter foot placement when stepping over obstacles or recovering from a trip [6]. It could therefore be proposed that foot sensation contributes to balance and gait control under more dynamic balance conditions than quiet stance and/or at specific time points (e.g. swing when the foot may come into contact with an obstacle) or locations on the feet. With this in mind, how effective might current sensory stimulating insole designs, which, most commonly, act by way of constant texture or vibration, be for rehabilitating or enhancing balance and gait control? In order to answer this question evidence of effectiveness of somatosensory rehabilitation paradigms and for sensory stimulating insoles on balance and gait outcomes will be discussed and directions for future research and development of rehabilitation interventions incorporating somatosensory stimulation considered. 1) Khan, F., et al., J Rehabil Med, 2016. 48(5): p. 442-8. 2) Patel, A., et al., Arch Phys Med Rehab 2000. 81(10): p. 1357-63. 3) Hyndman, D., et al., Arch Phys Med Rehab., 2002. 83(2): p. 165-70. 4) Parsons, S.L., et al., Top Stroke Rehabil, 2016. 23(5): p. 326-32. 5)Machado, A.S., et al., Arch Gerontol Geriatr, 2016. 63: p. 67-71. 6) Potocanac Z., et al., Exp Brain Res, 2014. Nov;232(11):3579-90.

Symposium XI Thursday, June 29, 3:30 - 5:15, *Location: Las Olas IV-VI*

Digging into data: What sensor signals from real-world falls can tell us

Chair: Ngaire Kerse, University of Auckland, New Zealand

Jochen Klenk, University of Bologna, Italy

What can we learn from real-world falls: description of movement and kinematics

The movement and kinematics of the human body during real-world falls is poorly understood. Fall definitions, fall risk models and fall detection algorithms are based on several assumptions about falls, which have not yet been proven true, mainly due to a lack of real-world falls data. The FARSEEING project has compiled a database of more than 200 real-world falls from older people, to bridge this gap. Several settings and disease groups have

been included, mainly geriatric rehabilitation, Parkinson's disease, cerebellar and sensory ataxia. Inertial sensors including accelerometers, gyroscopes and magnetometers were attached to the lower back (L5 position) in subjects with a known fall history. The part of the sensor signal including the fall has been identified based on fall reports. We extracted qualitative and quantitative parameters from all validated fall signals, including pre-fall activities, initial and final fall direction, and maximum vertical acceleration. Data-fusion algorithms have been used to estimate the sensor orientation during different fall phases. In this talk we will present the latest results of our analyses and compare them with current assumptions and data from simulation and video studies. The results will be used to discuss the validity of current fall definitions and the consequences for fall risk models. Furthermore, measured variables and reported information from the fallers will be compared to assess reporting quality.

Luca Palmerini, University of Bologna, Italy

Fall detection based on automatic algorithms that can learn the characteristic patterns and features of real-world falls: issues and results.

Technology is paramount in helping detect falls. Currently however, state of the art algorithms for fall detection using wearable sensors are still not performing accurately enough. Moreover, there is not a standard way yet to assess performance with a lot of heterogeneity among studies, making it difficult to compare them and understand what actually the best procedure to use is. Most importantly, most of the current approaches are validated on simulated falls that were already shown to be significantly different from real-world falls (Klenk et al 2011). Therefore, in order to develop systems that will be effective for fall detection in real life, the design of automatic algorithms which can learn the characteristic patterns and features of real-world falls is paramount. However, there are several issues in the construction of such a framework for fall detection. Among these issues, there can be heterogeneity of activity profiles of different subjects, problematic signals (signals that the algorithms cannot correctly identify), sensors' technical limitations such as saturation, heterogeneity in the choice of number, type and position of sensors, choice of a standard evaluation criteria, verification of falls and many others. We developed a complete framework for fall detection of real-world falls from the FARSEEING database (Klenk et al, 2016). We extracted traditional and novel features (Palmerini et al 2015) from the recorded signals in several real-life settings. Statistical and machine learning algorithms for automatic classification were applied to this data in order to automatically detect falls. We will show the issues and difficulties encountered during this process and we will show the methodology we developed in order to face these issues. We will present the latest results for fall detection of real-world falls highlighting the gaps that are still present in order to get to an effective, reliable and sustainable fall detection. We will present, discuss and investigate possible causes for representative examples of situations where the automatic algorithms are not, for now, able to distinguish between a fall and a normal activity.

Omar Aziz, Simon Fraser University, Canada

A machine learning based fall detection algorithm: A validation study using real-world fall and non-fall accelerometer data

INTRODUCTION: Falls are a major cause of injuries and deaths in older adults. Even when no injury occurs, about half of all older adults who fall are unable to get up without assistance and remain on the ground for an extended period of time. Wearable sensor based systems have been developed to automatically detect falls, and alert care providers of such events to hasten the delivery of medical assistance. However, despite exhibiting high classification accuracy in laboratory experiments, such sensor-based fall detection systems have yet to achieve high user acceptance and market penetration. One barrier to acceptance for such systems is the lack of evidence of their effectiveness in real-world falling scenarios in older adults. Therefore, the aim of this study is to examine the accuracy of our machine learning algorithm developed using accelerometer signals collected from a laboratory experiment, on the real-world fall and non-fall accelerometer data. **METHODS**: A fall classification model was first trained using accelerometer data from 10 subjects (aged 22-32) who participated in our

laboratory experiment simulating the most common causes of falls, observed in a library of video sequences of 227 real-life falls in older adults residing in long-term care facilities [1, 2]. The accuracy of the trained model was then tested on the real-world fall and non-fall datasets recorded with five young (aged 22-32) and 19 older adults (aged 56-94). With young adults, 28 hours of data were recorded as they went about their normal daily activities; no fall event was reported during that time. Among older adults, however, 10 falls were reported during the 386 hours of sensor data recording. While data with all young adults and 10 older adults were recorded at 128 Hz, using a tri-axial accelerometer (range ±6 g, APDM Inc., Portland, OR) worn at the waist, the data from remaining nine older adults were recorded at 100 Hz, using a tri-axial accelerometer (range ±2 g, Dynaport MiniMod, McRoberts, The Hague, NL) worn also at the waist. **RESULTS**: We found that our machine learning based fall classification model detected 8 out of 10 falls, and provided false positive rate that ranged from 0 to 0.3 false alarms per hour on the non-fall data recorded from older adults. Furthermore, our system did not report any false alarm on the 28 hours of recorded data from young adults. **CONCLUSIONS**: While our machine learning based fall detection system showed higher fall detection accuracy and substantially lower false positive rate than most of the existing fall detection systems, there is need for continuous efforts to collect real-world data within the target population to perform fall validation studies for fall detection systems on bigger real-world fall and non-fall datasets. REFERENCES: [1] Aziz, O. et al. MBEC. 1-11. 2016. [2] Robinovitch, S. et al. Lancet. 47-54. 2013.

Lars Schwickert, Robert Bosch Hospital, Germany

Get up! Resting and recovery after real falls.

BACKGROUND AND AIM: Falls are a major cause of injury and disability in older people. Besides direct consequences due to the impact of a fall, the inability to get up after falls is a common life threatening condition in older people. Yet, little is known about fall patterns including successful recovery after a fall and patterns with no recovery provoking long lies. One major obstacle to achieving a deeper understanding has been a lack of objective data from real-world fall events. Therefore, new insight into real-world fall signals from body-worn sensors will be given. Different kinematic features and patterns describing resting after a fall and falls with successful and unsuccessful recovery will be analyzed. The results will sharpen the picture of real-life falls and thereby help to describe, detect and understand critical incidents that require an automatic fall alarm to be sent. **METHODS**: The FARSEEING project has compiled a database of more than 300 real-world falls. A fall report, following a fall, was used to extract the fall signals. Smartphones including inertial sensors were worn in a waist belt at the L5 position by subjects with a known fall history. Several settings and disease groups have been included, mainly geriatric rehabilitation and Parkinson's disease. Signals including successful recovery and long lies after real-world falls were selected by at least two signal analysis experts from the FARSEEING database. Different recovery patterns were analyzed and acceleration and trunk orientation was evaluated as a basis for further fall analysis. The selected falls were labelled according to a specific fall model. **RESULTS**: Results extracted from real-world fall signals show that fall patterns including successful recovery after a fall can be distinguished from patterns with no recovery and long lies. The maximum duration of resting after a successful recovered fall was at 20 seconds. This differed significantly from non-recovered falls with considerably longer resting durations. Orientation merged with acceleration data can improve the understanding of post-fall body positions and thereby help detect and understand critical incidents that require an alarm to be sent off. **CONCLUSIONS**: Analysis of real-world fall signals with and without successful recovery showed different patterns. Recovery analysis will give insight into successful movement patterns helping to preventing long lies. Kinematic analysis and further pattern recognition can help to design tailored long-lie prevention interventions and improve fall-detection algorithms.

Symposium XII Thursday, June 29, 3:30 - 5:15, *Location: Oceanside II*

Can electrophysiology enhance our understanding and treatment of gait and posture in ageing and neurodegeneration?

Chair: **Meir Plotnik,** Sheba Medical Center, Israel

Evyatar Arad, Sheba Medical Center, Israel

Methodological aspects of recording and analyzing electroencephalographic signals during locomotion

Movement artifacts (MA) in electroencephalographic (EEG) signals originate from mechanical forces applied to the scalp electrodes, inducing small electrode movements relative to the scalp which, in turn, cause the recorded voltage to change irrespectively of cortical activity. These mechanical forces, and thus MA, may have various sources that are inherent to daily activities (e.g., ground reaction forces, head movements, etc.). In this talk, experimental measures to minimize MA in EEG and hardware advancements designed for MA reduction will be introduced. Furthermore, we will describe our study, aiming to (i) quantify MA in EEG during walking at different speeds and to (ii) asses our ability to prune it at various intensities (i.e., walking speeds) using state-of-the-art signal processing algorithms. Finally, we will present and discuss algorithms from statistical physics used to characterize cortical network activity and dynamics based on EEG data recorded during locomotion, and how these techniques can be used to delineate cortical functions related to gait. In our study, participants wore a 32-channel EEG cap while walking at various speeds both over-ground and on a treadmill. Data preprocessing included separating the EEG signals into statistically independent additive components using independent component analysis (ICA). MA was identified and quantified for each component by computing the spectral energy around a trial-specific stepping frequency. Based on this information, we developed an approach to remove MA contaminated components from the EEG signals. Figure 1 exemplifies a comparison of EEG signals before and after MA reduction, at various walking speeds (0.4 - 2.2 m/s). Our analyses suggest that the methodology effectively removes MA, even at high walking speeds. Acknowledgments: Israeli Ministry of Science and Technology, Grant # 3-12072 German Israel Foundation Grant # I-1298-415.13/2015 Israel Science Fund Grant # SF_1657_2016

Jesse Jacobs, Liberty Mutual Research Institutue for Safety, UK

Electroencephalography reveals unexpected insights about the mechanisms of impaired postural modulation by central set with Parkinson's disease

BACKGROUND AND AIM: People with Parkinson's disease (PD) do not modify their posture based on knowledge about task circumstances (i.e., based on central set). We aimed to investigate the hypothesis that impaired modulation of neural preparation underlies this impaired postural modulation. **METHODS**: In two separate studies and subject samples, we evaluated the electroencephalographic potentials of contingent negative variation (CNV) and beta event-related desynchronization (bERD) prior to externally induced postural perturbations of predictable versus unpredictable amplitude and prior to voluntary step initiation of predictable versus unpredictable selection of the stepping limb. **RESULTS**: Subjects with PD did not modulate the initial center-of-pressure displacement based on predictability of perturbation amplitude, nor did they modify the amplitude or number of anticipatory postural adjustments to the same extent as subjects without PD when stepping with versus without prior knowledge of the cued stepping limb. Despite this impaired postural modulation, compared to subjects without PD, the subjects with PD exhibited similar CNV modulation and enhanced bERD modulation prior to both external perturbations and voluntary step initiation. **CONCLUSIONS**: In cued conditions, impaired postural modulation with PD is not due to an impaired ability to modulate preparatory cortical activity, but perhaps due to greater influence of preparatory cortical activity to maintain unmodulated postural behavior.

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Bi-Hemispheric Phase Synchronization in Subjects with Parkinson's disease During Stance, Gait and Upper Limb Motor Tasks

BACKGROUND: Gait and postural disturbances, predominant clinical features of Parkinson's disease (PD), significantly affect patients' quality of life. The neural pathophysiology that underlies walking impairments in PD is not fully understood. The present study focuses on the contribution of inter-hemispheric and intra-hemispheric cortical dynamics to gait pathologies in PD. Since PD related impairments, symptomology and gait have asymmetric presentation we hypothesize that the inter-hemispheric synchronization will differ in PD as compared to healthy adults in particular during bilateral motor activation (e.g., free over ground walking). **METHODS**: We examined 15 patients with PD (age 67.7 ± 8 y; 3 women) and 8 healthy elderly controls (NPD) age 63 ±8.5 y; 5 women) while performing 1) one minute of quiet standing; 2) back-and-forth straight-line corridor walking; and 3) alternating and simultaneous hand tapping. EEG signals were recorded with a 32-electrode array (sampling rate 2048 Hz). The Fourier-mode phase synchronization (PS) method was used to quantify synchronization in periodic cortical activation between the two brain hemispheres (inter-hemispheric PS - IPS) and within each hemisphere (intra-hemispheric). PS ranges from 0 to 1, representing null to maximal synchronization, respectively. The theta (3.9-7.8 Hz), alpha (7.8-15.6 Hz) and beta (15.6-31.2 Hz) bands were studied. In addition, the relative difference between the left and the right intra-hemispheric PS values was calculated and defined as an Asymmetry Index (AI). **RESULTS**: IPS was significantly stronger among PD patients versus NPD subjects during standing, walking and turning in all bands (ANOVA; $F1, 20 \geq 28.9$; $p < 0.001$; e.g., Fig 1 left). Significantly lower IPS was found in the frontal theta band during the turning task (as compared to walking) in both groups ($p = 0.02$). Alternating and simultaneous hand tapping also led to a significantly increased IPS in the PD group compared to the control group in all bands. Only in the temporal lobe, the PD group exhibited significantly lower asymmetry (as reflected in the AI) compared to the control subjects in all the tasks ($p=0.002$; Fig 1 right). Significantly lower AI values were found in the frontal alpha band during simultaneous tapping task (as compared to the alternating tapping task) in both groups ($p=0.02$). **CONCLUSIONS**: Our findings suggest that excessive bi-hemispheric cortical synchronization may contribute, or alternatively be consequential to stance and gait disturbances in PD. To some extent, a high IPS comes in tandem with a more symmetrical activation of the two hemispheres. This study is one of a group of studies that addressed cortical activity (here expressed by EEG) while walking in patients with PD. This is the only one looking at inter-hemispheric synchronization, contrasting walking with other bilateral movements. **ACKNOWLEDGMENTS**: German Israel Foundation Grant #I-1298-415.13/2015

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Utilising neurophysiology to develop novel treatments for Freezing of Gait in Parkinson's Disease

Parkinson's disease (PD) affects 1-2% of people over 60y and over half of all patients will develop Freezing of Gait (FOG) where they have a paroxysmal inability to move their feet despite wanting to walk. This can lead to falls and not infrequently, nursing home placement. Recent studies utilising virtual reality gait paradigms (VR) in combination with functional neuroimaging have given some insights into the underlying neural correlates of the phenomenon of FOG in PD. These findings suggested that surface recordings taken from ambulatory EEG may also be used as a biomarker of the symptom and perhaps could even be able to predict individual events. Understanding the interplay between cortical and sub-cortical events during freezing has subsequently led to the evaluation of single cell recordings taken at the time of Deep Brain Stimulation surgery in patients performing VR. It is hoped that in future it might be possible to harness real-time neurophysiological data from recording/stimulating electrodes in conjunction with closed loop DBS to reduce FOG in PD.

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Authors and Presenters

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Poster Session 1

Monday, June 26 between 10:30 and 12:30

A Activity monitoring

1-A-1 ***Validation of the ActiGraph GT3X+ for measurement of physical activity in older adults in a semi-structured protocol using video analysis***

Alan Bourke[1], Espen Alexander Furst Ihlen[2], Per Bendik Wik[2], Ronny Bergquist[2], Jorunn lægdheim Helbostad[2]

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1-A-2 ***Accelerometer based measurement of Ambulatory Physical Activity in the community after treatment for lower extremity musculoskeletal cancer? A feasibility and validation study***

Sherron Furtado[1], Alan Godfrey[2], Brook Galna[2], Lynn Rochester[2], Craig Gerrand[1]

[1]Newcastle Upon Tyne Hospitals NHS Foundation Trust, [2]Newcastle University

1-A-3 ***Alterations in Community Stepping and Step Quality among Older Adults with Mild Cognitive Impairment***

Inbar Hillel[1], Shiran Shustak, Silvia Del Din[2], Esther Bekkers[3], Elisa Pelosin[4], Freek Nieuwhof[5], Anat Mirelman[1], Lynn Rochester[2], Jeffrey Hausdorff[1]

[1]Tel-Aviv Sourasky Medical Center, [2]Institute of Neuroscience, Clinical Ageing Research Unit, Newcastle University, [3]Department of Rehabilitation Sciences, [4]Genetics and Maternal Child Health, University of Genova, [5]Radboud University Medical Center

B Adaptation, learning, plasticity and compensation

1-B-4 ***Effect of unpredictable gait perturbation training on balance in individuals post-stroke***

Vahid EsmaeiliMahani[1], Laurent Bouyer[2], Dahlia Kairy[1], Anouk Lamontagne[3], JO Dyer[1], Cyril Duclos[1]

[1]Université de Montréal, [2]Université Laval, [3]McGill University

1-B-5 ***Does an external attentional focus improve motor learning after stroke? Results of a randomized controlled trial.***

Elmar Kal[1], John Van der Kamp[2], Han Houdijk[2], Manon Verhoef[1], Erny Groet[1], Coen Van Bennekom[1], Erik Scherder[2]

[1]Heliomare Rehabilitation Center, [2]VU University Amsterdam

1-B-6 ***Postural asymmetry does not influence the resultant vertical component of ground reaction forces during sit-to-stand***

Dominic Pérennou[1], Sébastien Baillieul[1], Sylvie Nadeau[2]

[1]University Hospital Grenoble-Alpes, [2]Montreal University

1-B-7 ***When You Adapt, You Retain: Locomotor Adaptation in ACLR and Implications for Rehabilitation***

Amanda Stone[1], Matthew Terza[1], Jaimie Roper[1], Chris Hass[1]

[1]University of Florida

C Aging

1-C-8 ***Psychometric properties of balance and strength measurements in independent living older adults using portable technologies***

Bader Alqahtani[1], Patrick Sparto[1], Susan Whitney[1], Susan Greenspan[1], Subashan Perera[1], Jennifer Brach[1]

[1]University of pittsburgh

1-C-9 ***The inter-rater reliability and agreement of compensatory stepping thresholds and strategies of older and young adults***

Shani Batcir[1], Hadar Sharon[1], Itshak Melzer[1]

[1]Faculty of Health Sciences, Ben-Gurion University of the Negev, Beer-Sheva, Israel

1-C-10 ***Auditory inputs contribute to balance control in healthy young and older adults: a simulated hearing loss experiment***

Victoria Kowalewski[1], Linda Thibodeau[1], Rita Patterson[1], Nicoleta Bugnariu[1]

[1]University of North Texas Health Science Center

1-C-11 ***Middle-aged adults have reduced ankle braking and push-off power in order to achieve the same gait speed as young adults***

Brittney Muir[1], Jeffrey Haddad[2], Richard van Emmerik[3], Shirley Rietdyk[2]

[1]The Sage Colleges, [2]Purdue University, [3]University of Massachusetts

1-C-12 ***Relationship between structural neuroimaging measures and performance on functional mobility measures in community-dwelling older adults***

Patrick Sparto[1], Nikki DiSalvio[1], Howard Aizenstein[1], Caterina Rosano[1], Subashan Perera[1], Mark Redfern[1], Joseph Furman[1], J Richard Jennings[1], Susan Whitney[1]

[1]University of Pittsburgh

1-C-13 ***Aging effect on step adjustments and stability control in visually perturbed gait initiation***

Ruopeng Sun[1], Chuyi Cui[2], John Shea[3]

[1]University of Illinois at Urbana-Champaign, [2]Purdue University, [3]Indiana University Bloomington

1-C-14 ***Mobility and cognition in nursing home residents.***

Gro Tangen[1], Karen Sverdrup[2]

[1]Norwegian National Advisory Unit on Ageing and Health/University of Oslo , [2]Norwegian National Advisory Unit on Ageing and Health

D Biomechanics

1-D-15 ***Effects of a Single Instruction Session on Balance Control During Motor Skill Learning of Krav Maga Punch Technique***

Vincenzo Di Bacco[1], Dmitry Verniba[1], Mehran Taherzadeh[1], Olivier Birot[1], William Gage[1]

[1]York University

1-D-16 ***Comparison of Stride Dynamics during Self-Paced, Fixed Speed, and Overground Walking***

Austin Duncan[1], Ryan Hartley[1], Casey Wiens[1], Will Denton[1], Molly Schieber[1], Vivien Marmelat[1]

[1]University of Nebraska Omaha

1-D-17 ***Biomechanics of the trailing limb during stair descent with the body facing diagonally forward***

Hiroaki Hayashi[1], Koichi Shinkoda[1], Motohiro Fukui[1], Wataru Kawakami[1], Makoto Takahashi[1]

[1]Hiroshima University

1-D-18 ***Influence of foot position on body mechanics during a sit-to-stand task***

Katia Turcot[1], Bianca Lachance[1]

[1]Université Laval

1-D-19 ***How to measure foot-placement accuracy during target stepping tasks: centre of pressure or centre of foot?***

Susanne van der Veen[1], Richard Baker[1], Kristen Hollands[1]

[1]University of Salford

1-D-20 ***Hop Distance Symmetry Does Not Reflect Normalization of Biomechanics in Pediatric Athletes Post-ACL Reconstruction***

Tishya Wren[1], Nicole Mueske[1], Christopher Brophy[2], James Pace[1], Mia Katzel[1], Curtis VandenBerg[1], Tracy Zaslow[1]

[1]Children's Hospital Los Angeles, [2]University of Southern California

E Brain imaging/activation during posture and gait

1-E-21 ***Anticipatory motor control develops through changes in connectivity between higher-order cognitive, somatosensory and cerebellar networks***

Fabien Cignetti[1], Marianne Vaugoyeau[1], Aurelie Fontan[1], Leslie Decker[2], Nadine Girard[3], Yves Chaix[4], Patrice Péran[4], Christine Assaiante[1]

[1]CNRS - Aix-Marseille Université, [2]INSERM - Université Caen-Normandie, [3]Assisstance Publique Hopitaux de Marseille, [4]INSERM U825 & Université Paul Sabatier III

1-E-22 ***EEG spectrum modulation during standing induced by optic flow and light finger touch***

Takahiro Kagawa[1], Makoto Miyakoshi[2], Scott Makeig[2], Johanna Wagner[2], John Iversen[2], Hiroyuki Kambara[3], Natsue Yoshimura[3], Hirokazu Tanaka[4], Jianwu Dang[4], Yoji Uno[1], Yasuharu Koike[3]

[1]Nagoya University, [2]University of California San Diego, [3]Tokyo Institute of Technology, [4]Japan Advanced Institute of Science and Technology

1-E-23 ***The effects of motor-cognitive training on prefrontal activation in patients with Parkinson's disease: an fNIRS study***

Anat Mirelman[1], Inbal Maidan[1], Freek Nieuwhof[2], Hagar Bernad-Elazari[1], Shiran Shustak[1], Jurgen Claassen[2], Nir Giladi[1], Jeffrey Hausdorff[1]

[1]Tel Aviv Sourasky Medical Center, [2]Radboud University Medical Center

1-E-24 ***Graph theoretical analysis of EEG functional connectivity during reactive and predictive balance control***

Jessy Parokaran Varghese[1], William McIlroy[2]

[1]University of Waterloo, [2]University of Waterloo, Canada

1-E-25 ***Cognitive activity measured by functional Near-Infrared Spectroscopy during walking tasks in young adults, older adults and clinical groups: a systematic review***

Paulo Pelicioni[1], Mylou Tijsma[2], Jasmine Menant[1], Stephen Lord[1]

[1]Neuroscience Research Australia, [2]Catharina Hospital

1-E-26 ***Activity in multiple frontal cortical areas during normal, fast and dual task walking: preliminary results of an fNIRS study***

Rodrigo Vitório[1], Lisa Alcock[2], Samuel Stuart[2], Ellen Lirani-Silva[2], Lynn Rochester[2], Annette Pantall[2]

[1]Newcastle University / Universidade Estadual Paulista (Unesp), [2]Newcastle University

F Cognitive impairments

1-F-27 ***Is habitual walking activity different in dementia compared to age-matched older adults?***

Ríona Mc Ardle[1], Brook Galna[1], Silvia Del Din[1], Alan Thomas[1], Lynn Rochester[1]

[1]Newcastle University

G Cognitive, attentional, and emotional influences

1-G-28 ***Dual-Task Balance Testing In Adolescents With And Without Sports-Related Concussion***

Abdulaziz Alkathiry[1], Patrick Sparto[2], Susan Whitney[2], Joseph Furman[2], Anthony Kontos[2]

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

1-G-29 ***Postural threat effects on conscious perception of whole body movement during continuous support surface rotations***

Taylor Cleworth[1], Allan Adkin[2], John Allum[3], Mark Carpenter[4]

[1]UBC, [2]Brock University, [3]University Hospital Basel, [4]Univeristy of British Columbia

1-G-30 ***Cognition and balance control: does processing of contextual cues of impending perturbations affect automatic postural responses?***

Daniel Coelho[1], Luis Teixeira[1]

[1]School of Physical Education and Sport - USP

1-G-31 ***Exploring thoughts and attentional focus of older adult fallers under anxiety***

Toby Ellmers[1], Adam Cocks[1], A. Williams[2], William Young[1]

[1]Brunel University London, [2]University of Utah

1-G-32 ***Gait and cognition in free-living; the effect of ambulatory bout length***

Rosie Morris[1], Silvia Del Din[1], Sue Lord[1], Lynn Rochester[1]

[1]Newcastle University

1-G-33 ***Avoidance strategies in response to phone messaging in healthy individuals walking in a virtual environment***

Wagner Souza Silva[1], Samir Sangani[2], Nancy Azevedo[1], Eva Kehayia[1], Anouk Lamontagne[1]

[1]McGill University, [2]Jewish Rehabilitation Hospital Laval

H Coordination of posture and gait

1-H-34 ***Reduced vestibular function is associated with longer, slower, more variable steps, and slowing of gait speed in healthy older adults***

Eric Anson[1], Woei-Nan Bair[2], Stephanie Studenski[2], Yuri Agrawal[1]

[1]Johns Hopkins School of Medicine, [2]Longitudinal Studies Section, National Institute on Aging

1-H-35 ***Waypoint Selection in Barrier Avoidance***

Brittany Baxter[1], William Warren[1]

[1]Brown University

1-H-36 ***Frontal asymmetry in leaning***

Daniëlle Bouman[1], John Stins[1], Peter Beek[1]

[1]MOVE Research Institution

1-H-37 ***Avoidance strategies in response to moving pedestrians in a physical vs. a virtual environment.***

Marco Buhler[1], Anouk Lamontagne[1]

[1]McGill University

1-H-38 ***Effect of a concomitant cognitive task on latency in different directions of step adjustment during walking***

Andréia Abud da Silva Costa[1], Luciana Oliveira dos Santos[1], Renato Moraes[1]

[1]Ribeirão Preto School of Medicine - FMRP-USP

1-H-39 ***Obstacle Avoidance Strategies of Soccer Players in Various Forms of Locomotion in Different Environmental Conditions***

Callum Fleming[1], Michael Cinelli [1]

[1]Wilfrid Laurier University

1-H-40 ***A follow-up study on the Influence of obesity on the postural sway of patients with type 2 diabetes mellitus.***

Kathrine Jáuregui-Renaud[1], Catalina Aranda-Moreno[1]

[1]Instituto Mexicano del Seguro Social

1-H-41 ***The Effect of Walking on Inclined Surfaces (Uphill and Downhill) on Gait Parameters using Self-Paced Treadmill in Virtual Environments***

Shani Kimel Naor[1], Amihai Gottlieb[1], Meir Plotnik[1]

[1]Sheba medical center

1-H-42 ***Differential Lower Limb Control Supports Interlimb Coordination during Normal and Forced Asymmetrical Walking***

Joshua Liddy[1], Scott Ducharme[2], Richard E. A. Van Emmerik[1], Jeffrey Haddad[1]

[1]Purdue University, [2]University of Massachusetts Amherst

1-H-43 ***Qualitative Assessment of Postural Dynamics: Evidence for a Chaotic Attractor***

Matheus Maia Pacheco[1], I-Chieh Lee[1], Karl Newell[1]

[1]The University of Georgia

1-H-44 ***Classification of trunk muscle coordination impairment in individuals with thoracic spinal cord injury***

Matija Milosevic[1], Hikaru Yokoyama[1], Murielle Grangeon[2], Kei Masani[3], Milos Popovic[4], Kimitaka Nakazawa[1], Dany Gagnon[5]

[1]University of Tokyo, [2]Pathokinesiology Laboratory, [3]Toronto Rehab, [4]University of Toronto, [5]University of Montreal

1-H-45 ***Effect of vision and dynamic stability margin on avoidance behaviours of older adults with double planar obstacles***

Jaime Mitchell[1], Michael Cinelli[1]

[1]Wilfrid Laurier University

1-H-46 ***Navigation through apertures by individuals with stroke***

Daisuke Muroi[1], Yasuhiro Hiroi[2], Teruaki Koshiba[2], Yohei Suzuki[2], Masahiro Kawaki[2], Takahiro Higuchi[1]

[1]Tokyo Metroplitan University, [2]Kamda Medical Center

1-H-47 ***Improvement of pelvic stability by neurosensory insoles***

Viviane nesme[1], MELLIE LAVENANT[1], Pierre-olivier morin[1], société connaissance et evolution [1]

[1]connaissance et evolution

1-H-48 ***Wavelet decomposition of sway reveals automaticity components in cognitive task conditions***

Natalie Richer[1], Yves Lajoie[1]

[1]University of Ottawa

1-H-49 ***Margin of dynamic stability is increased during walking combined with grasping in an unpredictable environment***

Natalia Rinaldi[1], Jongil Lim[2], Joseph Hamill[2], Renato Moraes[3], Richard van Emmerik[2]

[1]Federal University of Espirito Santo, [2]University of Massachusetts, [3]School of Physical Education and Sport

1-H-50 ***Attentional demands of curved- vs straight-path walking in older adults***

Michael Schwenk[1], Thomas Gerhardy [1], Lars Schwickert[2], Katharina Gordt[1]

[1]Heidelberg University, [2]Robert-Bosch Hospital

1-H-50 ***Attentional demands of curved- vs straight-path walking in older adults***

Michael Schwenk[1], Thomas Gerhardy [1], Lars Schwickert[2], Katharina Gordt[1]

[1]Heidelberg University, [2]Robert-Bosch Hospital

1-H-51 ***Spectral measures of centre of pressure: a marker of altered balance control after concussion in the general population.***

Michelle Sweeny[1], Olinda Habib Perez[1], Elizabeth Inness[2], Mark Bayley[2], Paul Comper[2], Cynthia Danells[2], Alana Coutts[2], George Mochizuki[3]

[1]University of Toronto, [2]Toronto Rehabilitation Institute, [3]Sunnybrook Research Institute

1-H-52 ***The importance of specific spatiotemporal parameters in the assessment of balance control in preschoolers***

Evi Verbecque[1], Luc Vereeck[1], Paul Van de Heyning[1], Ann Hallemans[1]

[1]University of Antwerp

J Devices to improve posture and gait

1-J-53 ***Assessment of stand-up and sit-down posture transition support by standing mobility Qolo for patients with paretic lower limbs***

Hideki Kadone[1], Yukiyo Shimizu[1], Shigeki Kubota[1], Keita Nakayama[1], Tetsuya Abe[1], Tomoyuki Ueno[1], Yasushi Hada[1], Kenji Suzuki[1], Masashi Yamazaki[1]

[1]University of Tsukuba

1-J-54 ***Retention of safer obstacle crossing behavior after virtual reality training***

Chanel LoJacono[1], Christopher Rhea[1]

[1]University of North Carolina at Greensboro

1-J-55 ***Fighting Freezing of Gait in Parkinson's disease: open-loop versus closed-loop cueing***

Martina Mancini[1], Graham Harker[1], Katrijn Smulders[1], John Nutt[1], Fay Horak [1]

[1]Oregon Health & Science University

L Ergonomics

1-L-56 ***Time dependency of bilateral weight distribution during prolonged standing***

April Chambers[1], Stephanie Wiltman[2]

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

M Exercise and physical activity

1-M-57 ***Effect of muscle fatigue on gait balance control during dual-task walking***

Li-Shan Chou[1], Szu-Hua Chen[1], Jocelyn Taylor[1]

[1]University of Oregon

1-M-58 ***Gait parameters change according to physical exercise features in Parkinson's disease.***

Lilian Gobbi[1], Juliana Lahr[1], Diego Jaime[1], Mayara Pestana[1], Paulo Pelicioni[2]

[1]São Paulo State University (UNESP), [2]University of New South Wales

1-M-59 ***Cycling as an exercise intervention for participants with Parkinson's Disease***

Lori Ann Vallis[1], Rhianna Malcolm[1], Philip Millar[1], Jamie Burr[1]

[1]University of Guelph

N Falls and fall prevention

1-N-60 ***Reactions evoked by sudden loss of balance: Are arm reactions that protect the body during impact with the ground strategies of last resort?***

James Borrelli[1], Jeanie Zabukovec[2], Simon Jones[3], Christiane Brown[4], Brian Maki[4]

[1]University of West Florida, [2]AGE-WELL Networks of Centres of Excellence, [3]Toronto Rehabilitation Institute - University Health Network , [4]Toronto Rehabilitation Institute - University Health Network - University of Toronto

1-N-61 ***Effectiveness of using a Kinect-based Rapid Movement Therapy (RMT) for fall prevention in chronic stroke survivors***

Kenneth Cheng[1], Melisa Junata[1], Hok-Sum Man[1], Wai-Kin Lai[2], Kai-Yu Tong[1]

[1]Chinese University of Hong Kong, [2]Shatin Hospital

1-N-62 ***Can visual fixation on an obstacle prevent trips?***

HyeYoung Cho[1], Michel Heijnen[2], Nathaniel Romine[1], Shirley Rietdyk[1]

[1]Purdue University, [2]University of North Carolina Wilmington

1-N-63 ***The Challenge of Virtual Reality Balance Games to the Balance Control System in Healthy Elderly: Exploring Muscle Activity***

Aijse de Vries[1], Jaap Dieën[2], Ilse Jonkers[1], Sabine Verschueren[1]

[1]KU Leuven, [2]VU University Amsterdam

1-N-64 ***Feasibility of detecting falls with wearable sensors at the lower back and thighs for possible integration into older adults' undergarments***

Andreas Ejupi[1], Chantel Galang[1], Thomas Burton[2], Daniel Plant[2], Stephen Robinovitch[1]

[1]Simon Fraser University, [2]Imperial College London

1-N-65 ***Gait balance classification of young adults, elderly non-fallers and fallers using center of mass velocity and acceleration***

Masahiro Fujimoto[1], Akinori Nagano[1], Li-Shan Chou[2]

[1]Ritsumeikan University, [2]University of Oregon

1-N-66 ***Evidence that small inconsistencies in step rise is neither perceived nor accommodated during stair ascent***

Mark Hollands[1], Denis Holzer[1], Thijs Ackermans[1], Natasha Francksen[1], Richard Foster[1], Mark Robinson[1], Vasilios Baltzopoulos[1], Kiros Karamanidis[2], Thomas O'Brien[1], Constantinos Maganaris[1]

[1]Liverpool John Moores University, [2]Deutsche SporthochSchule Koln

1-N-67 ***The dynamics of daily-life walking in older adult fallers and non-fallers: Is loss of complexity a reflection of loss of dynamic stability?***

Espen Alexander Ihlen[1], Aner Weiss[2], Jorunn Helbostad[1], Jeffrey Hausdorff[2]

[1]Norwegian University of Science and Technology, [2]Tel Aviv Sourasky Medical Center

1-N-68 ***Fear of falling in dizzy patients depends on external conditions***

Klaus Jahn[1], Roman Schniepp[1], Cornelia Schlick[1]

[1]University of Munich

1-N-69 ***Postural control, Trips and Slips in Community Dwelling Older Adults: MOBILIZE Boston Study***

Hyun Gu Kang[1], Jonathan Hsu[1]

[1]California State University San Marcos

1-N-70 ***Cognitive-motor gaming for reducing fall risk in chronic stroke survivors***

Lakshmi Kannan[1], Jinal Vora[1], Tanvi Bhatt[1]

[1]University of Illinois at Chicago

1-N-71 ***Age-associated factors contributing to obstacle negotiation abilities: Not all is as expected***

Ilan Kurz[1], Shlomit Eyal [2], Inbal Maidan[3], Anat Mirelman[3], Nir Giladi[3], Jeff Hausdorff[3]

[1]Department of Physical Therapy, Faculty of Health Sciences, Ben-Gurion University of the Negev, Beer-Sheva, Israel, [2]Department of Physical Therapy, Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel., [3]Center for the Study of Movement, C

1-N-72 ***Effects Of A Novel Two-Phase Rehabilitation Program On Fall Recovery Kinematics In Older Adults***

Evan Papa[1], Mahdi Hassan[1], Nicoleta Bugnariu[1]

[1]University of North Texas Health Science Center

1-N-73 ***Fall-risk during opposing stance perturbations among healthy adults and chronic stroke survivors.***

Prakruti Patel[1], Clive Pai[1], Tanvi Bhatt[1]

[1]University of Illinois at Chicago

1-N-74 ***Motor prediction modulates protective balance and startle responses to sudden drop perturbations in standing humans***

Ozell Sanders[1], Harshvardhan Singh[1], Hao Yuan Hsiao[1], Robert Creath[1], Mark Rogers[1]

[1]University of Maryland Baltimore

1-N-75 ***Balance Training with Augmented Feedback in Adults with Stroke***

Sara Snell[1], Jill Slaboda[1], Emily Keshner[1]

[1]Temple University

1-N-76 ***Evaluating ease of use, enjoyment and exercise adherence to 'Standing Tall' - a home-based exercise programme delivered through iPad technology for reducing fall risk in community-dwelling older people.***

Trinidad Valenzuela[1], Ashley Woodbury[2], Stephen Lord[3], Lillian Miles[2], Linda Pickett[2], Ashton May[2], Jessica Chow[2], Husna Razee[4], Kim Delbaere[2]

[1]University of New South Wales; Neuroscience Research Australia; Finis Terrae University, [2]Neuroscience Research Australia, [3]Neuroscience Research Australia; University of New South Wales, [4]University of New South Wales

O Habilitation & rehabilitation

1-O-77 ***Development of a clinical assessment tool for walking adaptability post-stroke: Preliminary results***

Chitra Balasubramanian[1], David Clark [2], Sergio Romero[2], Emily Fox[3]

[1]University of North Florida, [2]North Florida South Georgia Veterans Health System, University of Florida, [3]University of Florida

1-O-78 ***Amazing effects of neurosensory insoles on plantar pressure in people with chronic ankle instability***

Mellie Lavenant[1], Pierre-Olivier Morin[1], Institut de Formation Connaissance & Evolution[1]

[1]Connaissance & Evolution

1-O-79 ***Visual feedback to improve temporal gait asymmetry in people with stroke***

Jessica Powers[1], Jennifer Wong[2], Avril Mansfield[2], George Mochizuki[3], Dina Brooks[4], Kara Patterson[4]

[1]University of Toronto, [2]University Health Network, Toronto Rehabilitation Institute, [3]Sunnybrook Research Institute, [4]University of Toronto, Department of Physical Therapy

1-O-80 ***Music enjoyment has no influence on spatiotemporal gait parameters in healthy young adults***

Brittany Roberts[1], Jessica Grahn[1]

[1]Brain and Mind Institute

1-O-81 ***A longitudinal evaluation of gait recovery trajectory following Traumatic Brain Injury***

Conor Sheridan[1], Michael Thaut[1], Kara Patterson [1], Chelsea MacKinnon[1]

[1]University of Toronto

P Modeling

1-P-82 ***Modelling obstacle avoidance during locomotion with predictive and emergent processes***

Anuja Darekar[1], Valery Goussev[2], Bradford McFadyen[3], Anouk Lamontagne[1], Joyce Fung[1]

[1]McGill University, [2]Jewish Rehabilitation Hospital of the Centre Intégré de Santé et Services Sociaux de Laval (CISSS-La, [3]Laval University

Q Neurological diseases

1-Q-83 ***Balance and plantar pressure of indivicuals with diabetes during stair gait***

Patrick Antonio[1], Patrick Antonio[2], Stephen Perry[1]

[1]University of Toronto and Toronto Rehabilitation Institute, [2]University of Toronto

1-Q-84 ***Postural Control Over Multiple Trials of Wii Play in Individuals with Parkinson's Disease***

Tyler Baker[1], Rebecca Reed-Jones[1]

[1]University of Prince Edward Island

1-Q-85 ***Effects of side to obstacle circumvention during walking in people with Parkinson's disease***

Fabio Barbieri[1], Paula Polastri[2], Lilian Teresa Gobbi[3], Lucas Simieli[2], Vinicius Ignácio Pereira[2], André Baptista[2], Gabriel Moretto[2], Carolina Fiorelli[2], Luis Felipe Imaizumi[2], Sérgio Rodrigues[2]

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1-Q-86 ***The use of clinical balance scales to detect balance differences between freezers and non-freezers***

Esther Bekkers[1], Bauke Dijkstra[1], Kim Dockx[1], Elke Heremans[1], Sabine Verschueren[1], Alice Nieuwboer[1]

[1]KU Leuven

1-Q-87 ***Frequency-dependent cortical excitability in rhythmic movement with auditory cues in Parkinson's disease***

Hsiu-Yun Chang[1], Yu-Ting Hung[1], Jer-Junn Luh[1]

[1]National Taiwan University

1-Q-88 ***Instrumented gait analysis with wearable technology identifies potential markers for Parkinson's disease converters.***

Silvia Del Din[1], Morad Elshehabi[2], Markus Hobert[3], Ulrike Suenkel[2], Dina Salkovic[2], Daniela Berg[4], Lynn Rochester[1], Walter Maetzler[3]

[1]Newcastle University, [2]University Hospital Tübingen, [3]University Medical Center Schleswig-Holstein, [4]University Hospital Tübingen and University Medical Center Schleswig-Holstein

1-Q-89 ***Fragile X-associated tremor/ataxia syndrome, Parkinson's disease, and essential tremor subjects demonstrate distinct gait and balance deficits under normal, environmentally challenging, and dual-task conditions***

Erin Robertson[1], Andrew McAsey[1], Maija Swanson[1], Alexandra Bery[1], Colleen Huml[1], Elizabeth Berry-Kravis[1], Deborah Hall[1], Joan O'Keefe[1]

[1]Rush University Medical Center

1-Q-90 ***Influence of Osteoarthritis on Disease Characteristics, Mobility and Function in Patients with Parkinson's Disease***

Jaimie Roper[1], Samuel Wu[1], Peter Schmidt[1], Chris Hass[1], Michael Okun[1]

[1]University of Florida

1-Q-91 ***Lower limb muscle activity underlying temporal gait asymmetry post-stroke***

Gabriela Rozanski[1], Andrew Huntley[1], Lucas Crosby[1], Jennifer Wong[1], Alison Schinkel-Ivy[2], Avril Mansfield[3], Kara Patterson[4]

[1]Toronto Rehabilitation Institute - UHN, [2]Nipissing University, [3]Toronto Rehabilitation Institute/University of Toronto, [4]University of Toronto/Toronto Rehabilitation Institute

1-Q-92 ***Speeding up Gait in Parkinson's disease***

Katrijn Smulders[1], Martina Mancini[1], Peter Fino[1], John Nutt[1], Fay Horak[1]

[1]Oregon Health & Science University

1-Q-93 ***Differentiation of Parkinson's Disease and Atypical Parkinsonian Syndromes through Spatiotemporal Gait Analysis***

Kristen Sowalsky[1], Leonardo Almeida[1], Jared Skinner[1], Charles Jacobson IV[1], Nikolaus McFarland[1], Chris Hass[1]

[1]University of Florida

R Orthopedic diseases and injuries

1-R-94 ***Between-leg differences in challenging single-limb balance performance one year following anterior cruciate ligament reconstruction***

Anna Hatton[1], Kay Crossley[2], Ross Clark[3], Timothy Whitehead[4], Hayden Morris[5], Adam Culvenor[6]

[1]The University of Queensland, [2]La Trobe University, [3]University of the Sunshine Coast, [4]OrthoSport Victoria, [5]The Park Clinic, St Vincent's Private Hospital, [6]Institute of Anatomy, Paracelsus Medical University Salzburg & Nuremburg

1-R-95 ***After Total Knee Replacement Younger Patients are More Physically Active Compared to Older Patients***

Brian Street[1]

[1]*California State University, Bakersfield*

S Proprioceptive function and disorders

1-S-96 ***Is somatosensory function altered in people with Parkinson's disease and Freezing of Gait?***

Marcelo Pereira[1], **Ilke D'haese**[2], **Theresa Werner**[2], **Sanne Broeder**[2], **Alice Nieuwboer**[2]

[1]*Posture and Locomotion Studies Laboratory - São Paulo State University (Unesp), Institute of Biosciences,* [2]*KU Leuven*

U Sensorimotor control

1-U-97 ***Sensory modulation process is associated with gait in ecological conditions but not in a laboratory setting***

Maayan Agmon[1], **Tami Bar-Shalita**[2], **Rachel Kizony**[1]

[1]*University of Haifa,* [2]*Tel Aviv University*

1-U-98 ***Added postural sensorimotor training versus added sham exercise in physiotherapy of patients with chronic non-specific low back pain: A randomised controlled pilot trial***

Eling de Bruin[1], **Michael McCaskey**[1], **Corina Schuster-Amft**[2], **Brigitte Wirth**[3]

[1]*IBWS ETH,* [2]*Research Department / Reha Rheinfelden,* [3]*Interdisciplinary Spinal Research, Department of Chiropractic Medicine, University Hospital Balgrist*

1-U-99 ***Interaction between proprioception and vision during quiet standing in young healthy adults***

Cyril Duclos[1], **Noemie Duclos**[1], **Agnes Barthelemy**[2], **Michael Bertrand-Charette**[3], **Kevin Brunelle-Périard**[4], **Rebecca Chapman**[5], **Chesney Craig**[6], **Charline Dambreville**[3], **Andrea Cristina de Lima-Pardini**[7], **Wagner De Souza Silva**[8], **Lucie Dubreucq**[9], **Manuel Escalona**[1], **Sh**

[1]*Université de Montréal, School of rehabilitation,* [2]*Universite de Montreal,* [3]*Universite Laval,* [4]*Université-du-Quebec-a-Trois-Rivieres,* [5]*University of Prince Edward Island,* [6]*Queen's University Belfast,* [7]*University of Sao Paulo,* [8]*McGill University,* [9]*Center*

1-U-99 ***Interaction between proprioception and vision during quiet standing in young healthy adults***

Cyril Duclos[1], **Noemie Duclos**[1], **Agnes Barthelemy**[2], **Michael Bertrand-Charette**[3], **Kevin Brunelle-Périard**[4], **Rebecca Chapman**[5], **Chesney Craig**[6], **Charline Dambreville**[3], **Andrea Cristina de Lima-Pardini**[7], **Wagner De Souza Silva**[8], **Lucie Dubreucq**[9], **Manuel Escalona**[1], **Sh**

[1]*Université de Montréal, School of rehabilitation,* [2]*Universite de Montreal,* [3]*Universite Laval,* [4]*Université-du-Quebec-a-Trois-Rivieres,* [5]*University of Prince Edward Island,* [6]*Queen's University Belfast,* [7]*University of Sao Paulo,* [8]*McGill University,* [9]*Center*

1-U-100 ***Leg dominance influences the balance response mechanism to a visual perturbation***

Tyler Fettrow[1], **Hendrik Reimann**[1], **John Jeka**[1]

[1]*Temple University*

1-U-101 ***Locomotion though apertures as the person-plus-object system:when the body is off the center***

Takahiro Higuchi[1], **Maki Chiba**[2], **Masashi Kusumi**[2]

[1]*Tokyo Metropolitan University,* [2]*Honda R&D Co., Ltd.*

1-U-102 ***Different Influence of Vision and Touch on Postural Dynamics***

I-Chieh Lee[1], **Matheus Maia Pacheco**[1], **Karl Newell**[1]

[1]*University of Georgia*

1-U-103 ***Circuits for contextually dependent vestibulo-motor reflexes in the mouse***

Andrew Murray[1], **Simon Thompson**[1], **Emily Reader-Harris**[1]

[1]*University College London*

1-U-104 ***Effect of visual tasks on the coupling between visual information and body oscillation of older adults with and without falling history***

Paula Polastri[1], **Matheus Brito**[1], **Diego Lima**[1], **Beatriz Cavalieri**[1], **Rodolfo Moraes**[1], **Jose Barela**[2], **Fabio Barbieri**[1], **Sergio Rodrigues**[1]

[1]*Sao Paulo State University,* [2]*Cruzeiro do Sul University*

1-U-105 ***Intra-Modality Re-Weighting in Dyslexic Children's Postural Control***

Milena Razuk[1], **José Barela**[1]

[1]*Cruzeiro do Sul University - São Paulo, SP, Brazil.*

1-U-106 ***Investigating the effect of specific athletic training on performance during a reaction time task***

Natalie Snyder[1], **Michael Cinelli**[1]

[1]*Wilfrid Laurier University*

1-U-107 ***Steadiness constraint set by a manual task modulates dynamic balance control***

Luis Teixeira[1], **Joane Coutinho**[1], **Daniel Coelho**[1]

[1]*University of São Paulo*

V Tools and methods for posture and gait analysis

1-V-108 ***Understanding the relationship between postural response latencies and their relationship to visual induced instabilities***

James Chagdes[1], **Joshua Liddy**[2], **Jessica Huber**[2], **Shirley Rietdyk**[2], **Howard Zelaznik**[2], **Arvind Raman**[2], **Jeffrey Haddad**[1]

[1]*Miami University,* [2]*Purdue University*

1-V-109 ***Differences in the instrumented Timed Up and Go during single and dual task conditions among older adults***

Nimrod Geffen[1], **Moran Dorfman**[1], **Shlomit Eyal**[2], **Ilan Kurz**[3], **Inbal Maidan**[1], **Anat Mirelmam**[1], **Jefferey Hausdorff**[1]

[1]*Center for the study of Movement Cognition and Mobility,* [2]*Sackler Faculty of Medicine Tel Aviv ,* [3]*Recanati School of Health Professions, Ben Gurion University in the Negev*

1-V-110 ***Assessing the association between sensory perception and mobility performance using inertial sensors***

Katharina Gordt[1], **Thomas Gerhardy**[1], **Michael Schwenk**[1]

[1]*Network Aging Research*

1-V-111 ***Proposal of the Multiple Objective Optimal Design Example concerning the Structure of Mobile Force Plate Based on Biomechanical Evidence during Gait***

Yuichiro Hayashi[1]

[1]*Tokyo Metropolitan University*

1-V-112 ***Simplification of a whole-body anthropometric model to quantify postural stability in response to a surface perturbation***

Keaton Inkol[1], Andrew Huntley[2], Timothy Worden[1], Lori Ann Vallis[1]

[1]University of Guelph, [2]University Health Network

1-V-113 ***Measuring the Subjective Postural Vertical: Evaluation of the Test Procedure***

Carmen Krewer[1], Jeannine Bergmann[1], Friedemann Müller[1], Klaus Jahn[1]

[1]Schön Klinik Bad Aibling

1-V-114 ***The design of an obstacle device for treadmill gait studies***

Veronica Miyasike-daSilva[1], Jesse Jacobs[1], Peter Teare[1], Richard Holihan[1], Bahar Sharafi[1]

[1]Liberty Mutual Research Institute for Safety

1-V-115 ***Can foot placement errors accurately be derived from center of pressure data?***

Jolanda Roelofs[1], Iris Kolenbrander[1], Ellen Smulders[1], Ingrid Schut[2], Alfred Schouten[3], Vivian Weerdesteyn[1]

[1]Radboud university medical center, [2]Delft University of Technology, [3]Delft Univeristy of Technology

1-V-116 ***The effect of walking speed on quality of gait in older adults***

Kimberley van Schooten[1], Bas Huijben[2], Jaap van Dieen[2], Mirjam Pijnappels[2]

[1]Simon Fraser University/University of British Columbia, [2]VU University Amsterdam

1-V-117 ***Effect of ageing on the misalignment of the desired and measured center of pressure during straight walking***

Takeshi Yamaguchi[1], Ryosuke Okamoto[1], Zhiyu Liang[2], Kei Masani[3]

[1]Tohoku University, [2]Toronto Rehabilitation Institute-University Health Network, [3]Toronto Rehabilitation Institute-University Health Network, Institute of Biomaterials and Biomedica

W Vestibular function and disorders

1-W-118 ***Updated norms in balance testing for screening vestibular function***

Helen Cohen[1], Jasmine Stitz[2], Ajitkumar Mulavara[3], Brian Peters[3], Chris Miller[3], Haleh Sangi-Naghpeykar[1], Susan Williams[1], Jacob Bloomberg[4]

[1]Baylor College of Medicine, [2]University of Applied Sciences/ Upper Austria, [3]KBRwyle, [4]NASA/ Johnson Space Center

1-W-119 ***Sound determines the gait pattern of hearing impaired adults: results from a pilot study***

Ann Hallemans[1], Griet Mertens[2], Vincent Van Rompaey[2], Paul Van de Heyning[1]

[1]University of Antwerp, [2]Antwerp University Hospital

1-W-120 ***Postural responses to galvanic vestibular stimulation in adolescents with idiopathic scoliosis***

Vassilia Hatzitaki[1], Ioannis Chatzilazaridis[1], Eythimios Samoladas[1], Stavros Stavridis[2], Ioannis Amiridis[1]

[1]Aristotle University of Thessaloniki, [2]Agios Loukas Hospital

1-W-121 ***A multifaceted tailored randomised-controlled trial to improve quality of life, balance and gait in older people with dizziness***

Jasmine Menant[1], Jacqueline Close[1], Stephen Lord[1], Americo Migliaccio[1], Daina Sturnieks[1], Nick Titov[2], Catherine McVeigh[3]

[1]Neuroscience Research Australia, [2]Macquarie University, [3]Prince of Wales Hospital

X Visual function and disorders

1-X-122 ***Visualization of gaze shifting performance of healthy subjects and patients with neurodegenerative diseases***

Karin Srulijes[1], Christoph Schulz[2], David Mack[3], Jochen Klenk[1], Lars Schwickert[1], Michael Schwenk[1], Walter Maetzler[4], Daniel Weiskopf[2], Clemens Becker[1]

[1]Robert-Bosch-Hospital, [2]VISUS, University of Stuttgart, Stuttgart, Germany, [3]Clinic for Neurology, University Hospital Zurich, Switzerland, [4]Clinic for Neurology, University Hospital Schleswig-Holstein, Campus Kiel, Germany

Poster Session 2

Tuesday, June 27 between 10:30 and 12:30

A Activity monitoring

2-A-1 ***Monitoring changes in physical activity levels and intensity in preschool aged children; efficacy of a home based intervention***

Becky Breau[1], David Ma[1], Jess Haines[1], Lori Vallis[1]

[1]University of Guelph

B Adaptation, learning, plasticity and compensation

2-B-3 ***Evaluation of the accuracy and agreement in matching gait complexity to several complex auditory metronomes***

Vincenzo Di Bacco[1], Jeev Kiriella[1], Kristen Hollands[2], William Gage[1]

[1]York University, [2]University of Salford

2-B-4 ***Spatial and Temporal Aspects of Gait Are Controlled Separately: Evidence from Split-Belt Treadmill Adaptation***

Dorelle Hinton[1], David Conradsson[1], Caroline Paquette[1]

[1]McGill University

2-B-5 ***Effects of speed of walking on the accuracy of foot placement control in Stroke Survivors compared to age-matched control***

Susanne van der Veen[1], Ulrike Hammerbeck[2], Mark Hollands[3], Kristen Hollands[1]

[1]University of Salford, [2]Manchester University, [3]Liverpool John Moores University

C Aging

2-C-6 ***Concurrent Validity of APDM Opal Sensors and GAITRite Walkway in Older Adults***

Chitra Balasubramanian[1], Alys Cook[2], Sarah Humphrey[3], Jane Freund[2], Srikant Vallabhajosula[2]

[1]University of North Florida, [2]Elon University , [3]Elon University

2-C-7 ***The impact of visual attention on sensory integration during standing in the elderly***

April Chambers[1], J Jennings[1], Patrick Sparto[1], Joseph Furman[1], Mark Redfern[1]

[1]University of Pittsburgh

2-C-8 ***Age-associated changes in obstacle negotiation strategies***

Nimrod Geffen[1], Inbal Maidan[1], Eran Gazith[1], Lior Ravid[1], Shlomit Eyal[1], Ilan Kurz[1], Anat Mirelman[1], Jeffrey Hausdorff[1]

[1]Center for the study of Movement Cognition and Mobility

2-C-9 ***Perturbation training Improves Pelvic and Trunk Motion in Older Adults? A Randomized Control Trial***

Itshak Melzer[1], Yoav Gimmon[1], Raziel Riemer[1], Ilan Kurz[1], Amir Shapiro[1], Ronen Debi[2]

[1]Ben-Gurion University, [2]Barzilai Medical Centre

2-C-10 ***Compensatory rapid leg movement during unexpected loss of balance while walking - Age related differences***

Hadas Nachmani[1], Itzhak Melzer[1], Yoav Gimmon[1], Hadar Sharon[1], Ronen Debi[2], Amir Shapiro[3], ilan kurz[1]

[1]Faculty of Health Sciences at Ben-Gurion University of the Negev, [2]Barzilai Medical Center, [3]Ben-Gurion University of the Negev

2-C-11 ***Stability control during walking and obstacle crossing at fast speeds and its relationship to a clinical test battery in older adults***

Tiphanie Raffegeau[1], Sarah Brinkerhoff[1], Grace Kellaher[1], Matt Terza[1], Jaimie Roper[1], Lori Altmann[1], Chris Hass[1]

[1]University of Florida

2-C-12 ***Mediolateral and anteroposterior components of required coefficient of friction during turning gait for young and older adults***

Takeshi Yamaguchi[1], Ryosuke Okamoto[1], Kazuo Hokkirigawa[1]

[1]Tohoku University

D Biomechanics

2-D-13 ***The Effects Of Imposing Temporal & Spatial Gait Asymmetry On Knee Joint Kinetic***

Sultan Alharbi[1], Kriestan Hollands[1], Richard Jones[1]

[1]University of Salford

2-D-14 ***Mechanical economy during walking on gradients***

Arthur Dewolf[1], Yuri Ivanenko[2], Francesco Lacquaniti[3], Patrick Willems[1]

[1]Université catholique de Louvain, [2]IRCCS Santa Lucia Foundation, [3]University of Rome Tor Vergata

2-D-15 ***Foot postures have different influences on hallucal loading, with the arch height in individuals with hallux valgus being a determining factor.***

Wataru Kawakami[1], Koichi Shinkoda[1], Tomonori Sawada[1], Makoto Takahashi[1]

[1]Hiroshima University

2-D-16 ***Kinematic analysis during virtual-reality dance-based gaming in aging and stroke: A Cross-Sectional Study***

Ernest Ofori[1], Gorlon Teah[1], Savitha Subramaniam[1], Tanvi Bhatt[1]

[1]University of Illinois at Chicago

2-D-17 ***Reliability of Daily Motor Activity variability recorded over 7 days***

Nick Reynolds[1], Vivien Marmelat[1]

[1]University of Nebraska at Omaha

2-D-18 ***Biomechanical influences of gait termination with holding of baggage in one hand***

Masaki Sanada[1], Koichi Shinkoda[1], Kenji Tanimoto[1], Motohiro Fukui[1], Makoto Takahashi[1]

[1]Hiroshima University

E Brain imaging/activation during posture and gait

2-E-19 ***The role of the prefrontal cortex during walking over ground and walking on treadmill in patients with Parkinson's Disease***

Pablo Cornejo Thumm[1], Inbal Maidan[1], Shiran Shustak[1], Eran Gazit[1], Shirley Shema[1], Marina Brozgol[1], Hagar Bernad[1], Yoav Beck[1], Anat Mirelman[1], Jeffrey Hausdorff[1]

[1]Tel Aviv Sourasky Medical Center

2-E-20 ***The Energy Cost of Walking While Thinking***

Alex Krajek[1], KayLynn Bland[1], Taylor Woods[1], James Lang[1], Kristin Lowry[1], Jessie VanSwearingen[2]

[1]Des Moines University, [2]University of Pittsburgh

2-E-21 ***The effect of changing visual information on brain activity during sensory integration in young adults- a functional NIRS study***

Chia-Cheng Lin[1], Benjamin Williams[1], Amanda MacCreery[1], Theodore Huppert[2], Parick Sparto[1]

[1]East Carolina University, [2]University of Pittsburgh

2-E-22 ***Influence of STN stimulation in intra stride cortical dynamics in Parkinson's disease***

Marlieke Scholten[1], Johannes Klemt[2], Alireza Gharabaghi[3], Rejko Krüger[4], Daniel Weiss[2]

[1]Hertie Institute for clinical brain research, [2]Hertie Institute, [3]Universitaetsklinikum Tübingen, [4]Luxembourg Center for Systems Biomedicine

2-E-23 ***Functional near infra-red spectroscopy during walking in young, old and Parkinson's disease: a structured review***

Rodrigo Vitório[1], Samuel Stuart[2], Lynn Rochester[2], Annette Pantall[2], Lisa Alcock[2]

[1]Newcastle University / Universidade Estadual Paulista (Unesp), [2]Newcastle University

F Cognitive impairments

2-F-24 ***Gait in dementia subtypes: A step in the right direction?***

Ríona Mc Ardle[1], Brook Galna[1], Rosie Morris[1], Joanna Wilson[1], Alan Thomas[1], Lynn Rochester[1]

[1]Newcastle University

2-F-25 ***Vestibular Contributions to Cognitive Function: An Investigation of Prevalence and Potential Mechanisms.***

S.S Surenthiran[1]

[1]University of Kent

G Cognitive, attentional, and emotional influences

2-G-26 ***Effect of visual dependence and task loads on the TUG sub-components in old and young adults***

Rania Almajid[1]

[1]Temple University

2-G-27 ***The Effects of Task Prioritization on Postural-suprapostural Task in Parkinson's Disease Patients with Different Balance Ability***

Yu-An Chen[1], Shu-Han Yu[2], Yu-Ting Hung[1], Cheng-Ya Huang[1]

[1]National Taiwan University, Taipei, Taiwan, [2]National Taiwan University Hospital, Taipei, Taiwan

2-G-28 ***Obstacle height, one's location and dual-tasking influence obstacle clearance parameters in older adults***

Deborah Jehu[1], Nicole Paquet[1], Yves Lajoie[1]

[1]University of Ottawa

2-G-29 ***Executive function predicts gait velocity in pre-rehabilitation Traumatic Brain Injury***

Chelsea Mackinnon[1], Conor Sheridan[1], Kara Patterson[1], Michael Thaut[1]

[1]University of Toronto

2-G-30 ***Does cognitive-motor interference differ with postural demands of balance tasks in individuals aging with and without a stroke?***

Prakruti Patel[1], Tanvi Bhatt[1]

[1]University of Illinois at Chicago

2-G-31 ***Clinical efficiencies of stabilometry and visual feedback test for differentiating the patients with psychogenic vertigo from healthy subjects.***

Tomoe Yoshida[1], Masahiko Yamamoto[1], Yoshihiro Ikemiyagi[1], Fuyuko Ikemiyagi[2], Mitsuya Suzuki[1]

[1]Toho University Sakura Medical Center, [2]Misato Central general hospital

H Coordination of posture and gait

2-H-32 ***Segmental Evaluation of the Spinal Movement in Gait by Rasterstereography***

Ulrich Betz[1], Janine Huthwelker[1], Jürgen Konradi[1], Helmut Diers[1], Philipp Drees[1]

[1]University Medical Center of the Johannes Gutenberg University Mainz, Germany

2-H-33 ***Variability of the center of mass and base of support during gait altered in persons with multiple sclerosis***

Jordan Craig[1], Adam Bruetsch[2], Sharon Lynch[2], Jessie Huisinga[2]

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

2-H-34 ***Differential Changes to Gait Parameter Fractality During Asymmetric Walking***

Scott Ducharme[1], Joshua Liddy[2], Richard van Emmerik[1]

[1]University of Massachusetts, Amherst, [2]Purdue University

2-H-35 ***Characterizing slips during gait using an entire support surface perturbation: Comparisons to previously established slip methods***

Andrew Huntley[1], Roshanth Rajachandrakumar[1], Gabriela Rozanski[1], Alison Schinkel-Ivy[2], Avril Mansfield[1]

[1]Toronto Rehabilitation Institute - University Health Network, [2]Nipissing University

2-H-36 ***How does stepping-over behavior change depending on the obstacle height?***

Kentaro Kodama[1], Kazuhiro Yasuda[2], Kohei Sonoda[3]

[1]Kanagawa University, [2]Waseda University, [3]Ritsumeikan University

2-H-37 ***Does holding an object benefit the performance of a standing precision manual task?***

, Joshua Liddy[1], Nathaniel Romine[1], Hye Young Cho[1], Amanda Arnold[1], Hoda Salsabili[1], Chuyi Cui[1], Jeffrey Haddad[1]

[1]Purdue University

2-H-38 ***Does geometry of feet positioning on the ground affect muscular responses in the lower limbs? Comparison between the gastrocnemius and soleus muscles***

Nametala Maia Azzi[1], Daniel Coelho[1], Luis Teixeira[1]

[1]University of São Paulo

2-H-39 ***Neuromuscular control of stepping in response to uneven terrain.***

Gary Mangan[1], Luke Denomme[1], Stephen Prentice[1], James Frank[1]

[1]University of Waterloo

2-H-40 ***Postural and stepping strategies on turning while walking.***

Takahito Nakamura[1], Fumihiko Hoshi[2]

[1]Rehabilitation Amakusa hospital, [2]Saitama prefectural university

2-H-41 ***Effects of cognitive tasks on postural control mode in young and older adults***

Alexandra Potvin-Desrochers[1], Natalie Richer[1], Deborah Jehu[1], Alan Chan[1], Yves Lajoie[1]

[1]University of Ottawa

2-H-42 ***Assessing the effects of sport-related head impacts on football defensive linemen's balance control over the course of a season***

Alyssa Prangley[1], Natalie Figueira[1], Michael Cinelli[1]

[1]Wilfrid Laurier University

2-H-43 ***Distinct patterns of coordination when stepping over obstacles at different distances***

Roshita Rathore[1], Hendrik Reimann[1], John Jeka[1]

[1]Temple University

2-H-44 ***Modality of a cognitive task impacts postural sway in healthy older adults***

Natalie Richer[1], Francis Tessier[1], Yves Lajoie[1]

[1]University of Ottawa

2-H-45 ***Effects of maneuverability range and acoustic pacing on stride-to-stride dynamics in treadmill walking***

Melvyn Roerdink[1], Lisette Smid[1], Christa de Jonge[1], Andreas Daffertshofer[1]

[1]Research Institute MOVE, VU University Amsterdam

2-H-47 ***Exploring the relationship between muscle strength and function following perturbations during gait initiation***

David Shulman[1], Abbigale Spencer[1], Keaton Inkol[1], Lori Ann Vallis [1], John Srbely [1]

[1]University of Guelph

2-H-48 ***Healthy aging influences the role of spatially tuned preparatory postural muscle activity during standing reach***

Alexander Stamenkovic[1], Joel Walsh[1], Darryl McAndrew[1], Sergio Jimenez[1], Sophie Bos[1], Paul Stapley[1]

[1]Illawarra Health and Medical Research Institute, University of Wollongong

2-H-49 ***A 30-km hiking challenge in very vital older adults led to reduced postural stability in quiet stance***

Geert van Bon[1], Sanne Gijzel, Thijs Eijsvogels, Maria Hopman, René Melis, Marcel Olde Rikkert, Vivian Weerdesteyn

[1]Donders Institute for Brain, Cognition and Behaviour, Radboud university medical center

I Developmental disorders

2-I-50 ***Where is the subjective straight ahead in Williams syndrome?***

Arnaud Saj[1], Julie Heiz[2], Koviljka Barisnikov[2]

[1]University Hospital of Geneva, [2]University of Geneva

J Devices to improve posture and gait

2-J-51 ***Assessment of individuals with chronic stroke walking with body weight unloading on a treadmill and over the ground***

Ana Barela[1], Melissa Celestino[1], Gabriela Gama[1], José Barela[1]

[1]Cruzeiro do Sul University

2-J-52 ***A Wearable Control Moment Gyroscope for Postural Assistance and Stabilization***

Kotaro Furuki[1], Hideki Kadone[1], Kenji Suzuki[1]

[1]University of Tsukuba

K Effect of medication on posture and gait

2-K-53 ***The Effect of Stochastic Resonance Stimulation on Multi-sensory Fusion for the Balance in Children with Cerebral Palsy: Preliminary Results***

Sungjae Hwang[1], Anastasia Zarkou[2], Laura Prosser[3], Samuel Lee[2], John Jeka[1]

[1]Temple University, [2]University of Delaware, [3]Children's Hospital of Philadelphia

L Ergonomics

2-L-54 ***Utilization of Active Cooling on Postural Balance while Wearing Firefighter's Ensemble in Warm Humid Environment***

Ali Aljaroudi[1], Amit Bhattacharya[2], Amanda Strauch[3], Tyler Quinn[3], Warren Williams[3]

[1]Centers for Disease Control and Prevention (CDC) - National Institute for Occupational Safety and Health (NIOSH), [2]University of Cincinnati, [3]Centers for Disease Control and Prevention (CDC) - National Institute for Occupational Safety and Health

M Exercise and physical activity

2-M-55 ***An video analysis of the distribution of uninterrupted walking bout in an older adult population***

Alan Bourke[1], Espen Alexander Furst Ihlen[2], Jorunn lægdheim Helbostad[2]

[1]Department of Neuroscience, Faculty of Medicine, Norwegian University of Science and Technology, Trondheim, Norway., [2]Department of Neuroscience, Faculty of Medicine, Norwegian University of Science and Technology, Tro

2-M-56 ***Is the baseline performance of a cognitive single-task related to dual-task training effects?***

Niklas Löfgren[1], David Conradsson[1], Linda Rennie[2], Breiffni Leavy[1], Erika Franzén[1]

[1]Karolinska Institutet , [2]Sunnaas Rehabiltation Hospital

2-M-57 ***Factors related to life-space mobility in patients with chronic stroke***

Hideyuki Tashiro[1]

[1]Sapporo Medical University

N Falls and fall prevention

2-N-58 ***Step length as the primary temporal-spatial determinant of minimum foot clearance during overground gait in Parkinson's Disease***

Lisa Alcock[1], Ruth Perkins[2], Brook Galna[1], Sue Lord[1], Lynn Rochester[1]

[1]Newcastle University Institute for Ageing, Newcastle University, [2]Newcastle University

2-N-59 ***Contribution of the arms to recovery after a trip in older adults***

Sjoerd Bruijn[1], Lizeth Sloot[1], Idsart Kingma[1], Jaap Van Dieen[1], Mirjam Pijnappels[1]

[1]VU University Amsterdam

2-N-60 ***Effect of a six-week virtual reality treadmill training falls prevention intervention on macro gait outcomes of free-living walking activity.***

Silvia Del Din[1], Sue Lord[1], Alan Godfrey[1], Brook Galna[1], Esther Bekkers[2], Elisa Pelosin[3], Freek Nieuwhof[4], Anat Mirelman[5], Jeffrey Hausdorff[6], Lynn Rochester[1]

[1]Newcastle University, [2]KU Leuven, [3]University of Genova, [4]Radboud university medical center, [5]Tel Aviv Sourasky Medical Center, [6]Tel Aviv Sourasky Medical Center, Sackler School of Medicine and Sagol School of Neuroscience

2-N-61 ***Alterations of gait and balance in relation to urgent desire to void in older female fallers with and without incontinence***

Lucie Dubreucq[1], Marie-Hélène Paquin[1], Jean Meunier[1], Johanne Filiatrault[1], Alain St-Arnaud[2], Nolwenn Lapierre[1], Hélène Moffet[3], Melanie Morin[4], Marie-Hélène Milot[4], Jacqueline Rousseau[1], Chantal Dumoulin[1], Cyril Duclos[1]

[1]Université de Montréal, [2]Health and social service center Lucille-Teasdale, [3]Université Laval, [4]Université Sherbrooke

2-N-62 ***Smarter Balance System: Smartphone-based biofeedback technology for clinical and/or home-based balance rehabilitation***

Alberto Fung[1], Eugine Lai[2], Beom-Chan Lee[1]

[1]University of Houston, [2]3Methodist Neurological Institute

2-N-63 ***A New Model of Community Fall Prevention: Music-based Multitasking (Jaques-Dalcroze Eurhythmics) for Older Adults and Kinesiology Students***

Hyun Gu Kang[1], Shoko Hino[1], Rodney Beaulieu[1]

[1]California State University San Marcos

2-N-64 ***Why are Parkinson's disease patients prone to falls during turning? Can we model dysfunction in healthy young participants?***

Fuengfa Khobkhun[1], Mark Hollands[2], Amornpan Ajjimaporn[3]

[1]Liverpool John Moores University,UK and Mahidol University,Thailand, [2]Liverpool John Moores University, UK, [3]Mahidol University, Thailand

2-N-65 ***On-site perturbation-based balance recovery training among residents of retirement communities - preliminary results***

Michael Madigan[1], Jessica Aviles[1], Leigh Allin[1], Neil Alexander[2], Maury Nussbaum[3]

[1]Texas A&M University, [2]University of Michigan, [3]Virginia Tech

2-N-66 ***Feasibility and efficacy of reactive step training using unpredictable slips and trips in young and older adults***

Yoshiro Okubo[1], Matthew Brodie[1], Daina Sturnieks[1], Stephen Lord[1]

[1]Neuroscience Research Australia

2-N-67 ***Protective stepping in people with MS: effects of a single bout of practice***

Daniel Peterson[1], Kris Kratz[2], Bo Foreman[3], Leland Dibble[3]

[1]Arizona State University, [2]Phoenix VA Medical Center, [3]University of Utah

2-N-68 ***Does a perturbation based gait intervention enhance gait stability in fall prone stroke survivors?***

Michiel Punt[1], Sjoerd Bruijn[2], Harriet Wittink[1], Jaap van Dieen[1], Ingrid van de Port[3]

[1]Hogeschool Utrecht, [2]Vrije Universiteit Amsterdam, [3]Revant

2-N-69 ***Elderly fallers enhance dynamic stability through anticipatory postural adjustments during a choice stepping reaction time***

Thomas Robert[1], Romain Tisserand[1], Pascal Chabaud[2], Marc Bonnefoy[3], Laurence Cheze[1]

[1]Université de Lyon - IFSTTAR, [2]Université de Lyon, [3]Centre Hospitalier Lyon Sud

2-N-70 ***Deficits in motor imagery of gait among older adults predict future development of fear of falling***

Ryota Sakurai[1], Masashi Yasunaga[1], Hiroyuki Suzuki[1], Kazuyuki Kanosue[2], Yoshinori Fujiwara[1]

[1]Tokyo Metropolitan Institute of Gerontology, [2]Waseda University

2-N-71 ***Relationship between the balance ability and the acceleration of the start & end movement of sit to stand five times test***

Jeongwoo Seo[1], Dongwon Kang[1], Jinseung Choi[1], Taeho Kim[1], Hyemi Jo[1], Gyerae Tack[1]

[1]Konkuk Univ.

2-N-72 ***Effects of a busy day on fatigue, physical function and fall risk in older people***

Daina Sturnieks[1], Jasmine Menant[1], Sin Lin Yak[2], Mayna Ratanapongleka1[1], Stephen Lord[1]

[1]Neuroscience Research Australia, [2]University of New South Wales

2-N-73 ***Automated detection of multidirectional compensatory balance responses during gait using wearable IMUs***

James Tung[1], Mina Nouredanesh[1], Katharina Gordt[1], Michael Schwenk[2]

[1]University of Waterloo, [2]Robert-Bosch Hospital

2-N-74 ***Younger and Older COPD Patients Demonstrate Balance Deficits as Compared to Controls***

Jenna Yentes[1], Jordan Freeman[1], Casey Caniglia[1], Stephen Rennard[2]

[1]University of Nebraska at Omaha, [2]AstraZeneca

0 Habilitation & rehabilitation

2-0-75 ***The effect of 2 weeks of vibrotactile biofeedback of trunk sway on balance control in multiple sclerosis: a pilot study***

John Allum[1], Heiko Rust[1], Valerie Zumbrunnen[2], Michaela Imhof[3], Nathanael Lutz[3], Oezguer Yaldizli[1]

[1]University Hospital Basel, [2]University ofApplied Sciences, [3]University of Applied Sciences

2-0-76 ***The use of rhythmic auditory cues during gait in Parkinson's disease: influence of disease progression on cued response.***

Ellen Lirani-Silva[1], Rosie Morris[2], Sue Lord[2], Lynn Rochester[2]

[1]Universidade Estadual Paulista/ Newcastle University, [2]Newcastle University

2-0-77 ***The effect of Virtual Reality gait training on motor and cognitive function among children with Attention Deficit Hyperactivity Disorder***

Shirley Shema Shiratzky[1], Marina Brozgol[1], Pablo Cornejo Thumm[1], Karen Geva Dayan[1], Michael Rotstein[1], Yael Leitner[1], Jeffrey Hausdorff[1], Anat Mirelman[1]

[1]Tel Aviv Sourasky Medical Center

2-O-77 ***The effect of Virtual Reality gait training on motor and cognitive function among children with Attention Deficit Hyperactivity Disorder***

Shirley Shema Shiratzky[1], Marina Brozgol[1], Pablo Cornejo Thumm[1], Karen Geva Dayan[1], Michael Rotstein[1], Yael Leitner[1], Jeffrey Hausdorff[1], Anat Mirelman[1]

[1]Tel Aviv Sourasky Medical Center

2-O-78 ***Validation of rating of perceived difficulty scales for balance exercises using postural sway measures***

Patrick Sparto[1], Saud Alsubaie[2], Gregory Marchetti[3], Kathleen Sienko[4], Joseph Furman[1], Susan Whitney[1]

[1]University of Pittsburgh, [2]Prince Sattam Bin Abdulaziz University, [3]Duquesne University, [4]University of Michigan

2-O-79 ***Pelvic support vs. pelvic constraints: Immediate after effects of robot assisted gait training in LOPES II on overground walking in healthy subjects***

Vivian Weerdesteyn[1], Jolanda Alingh[2], Bart Nienhuis[2], Brenda Groen[3], Alexander Geurts[1]

[1]Radboud University Medical Centre, [2]Sint Maartenskliniek Research, [3]Sint Maartenskliniek

Q Neurological diseases

2-Q-80 ***Lower-Limb Muscle Strength Associates with Parkinson's Disease Stage Independent of Age***

Mélanie Beaulieu[1], Martijn Müller[1], Nicolaas Bohnen[1]

[1]University of Michigan

2-Q-81 ***Gait asymmetry in people with Parkinson's disease is linked to reduced integrity of callosal sensorimotor regions***

Carolin Curtze[1], Brett Fling[2], Fay Horak[1]

[1]Oregon Health & Science University, [2]Colorado State University

2-Q-82 ***The sudden stop-and-start test of the Interactive Walkway affords an innovative evaluation of freezing of gait in Parkinson's disease patients***

Daphne Geerse[1], M. Roerdink[1], H. Coolen[1], P.W. Ouwehand[2], J. Marinus[2], J.J. van Hilten[2]

[1]MOVE Research Institute Amsterdam, [2]Leiden University Medical Center

2-Q-83 ***Characteristics of Balance Control to Unexpected Loss of Balance in Stroke Individuals.***

Shirley Handelzalts[1], Itshak Melzer[2], Nachum Soroker[1]

[1]Loewenstein Hospital Rehabilitation Center, Israel, [2]Ben-Gurion university, Israel

2-Q-84 ***Is cognitive decline similar among Parkinson's disease motor sub-types? A prospective study examining changes over time in gait, balance and cognition***

Talia Herman- Feinstein[1], Liraz Arie[2], Shirley Shema-Shiratzky[1], Nir Giladi[1], Jeffrey Hausdorff[1]

[1]Tel Aviv Sourasky Medical Center, [2]Department of Physical Therapy, Sackler Faculty of Medicine, Tel Aviv University

2-Q-85 ***Gait disturbance in patients with orthostatic tremor***

Ken Möhwald[1], Max Wuehr[1], Katharina Feil[1], Fabian Schenkel[1], Cornelia Schlick[1], Roman Schniepp[1]

[1]University Hospital of Munich, LMU, Campus Großhadern

2-Q-86 ***Effect of mild and marked cognitive impairment on gait stability and risk of falls in people with Parkinson's disease***

Paulo Pelicioni[1], Jasmine Menant[1], Matthew Brodie[1], Emily Henderson[2], Mark Latt[3], Stephen Lord[1]

[1]Neuroscience Research Australia, [2]University of Bristol, [3]Royal Prince Alfred Hospital

2-Q-87 ***The reliability of gait variability measures in Parkinson's disease - Effects of gait speed.***

Linda Rennie[1], Niklas Löfgren[2], Rolf Moe-Nilssen[3], Erika Franzén[4]

[1]Sunnaas Rehabilitation Hospital, [2]Karolinska Institutet, [3]University of Bergen, [4]Karolinska Institutet AND Karolinska University Hospital, Stockholm

2-Q-88 ***Are anticipatory postural adjustments prior to gait initiation compromised in people with Parkinson's disease with freezing of gait?***

Christian Schlenstedt[1], Fay Horak[2], John Nutt[2], Martina Mancini[2]

[1]University Kiel, [2]Oregon Health & Science University

2-Q-89 ***Influence of obstacle height on variability of obstacle crossing step in people with Parkinson's disease***

Lucas Simieli[1], Fabio Barbieri[1], Diego Orcioli-Silva[2], André Baptista[1], Vinicius A. Pereira[1], Victor Beretta[2], Lilian T Gobbi[2]

[1]Univ Estadual Paulista at Bauru - UNESP, [2]Univ Estadual Paulista at Rio Claro - UNESP

2-Q-90 ***Inter-rater reliability of mobile eye-tracking when walking in Parkinson's disease: contextual analysis***

Samuel Stuart[1], David Hunt[1], Jeremy Nell[1], Alan Godfrey[1], Lynn Rochester[1], Lisa Alcock[1]

[1]Newcastle University

2-Q-91 ***Dance for Stroke: A virtual-reality dance based exercise to increase cardiovascular fitness and community ambulation in individuals with chronic stroke: A preliminary study***

savitha subramaniam[1], Tanvi Bhatt[1]

[1]UIC

R Orthopedic diseases and injuries

2-R-92 ***Differences in gait speed between cognitively impaired and cognitively normal lower extremity amputees: Pilot study preliminary data***

Courtney Frengopoulos[1], Michael Payne[2], Ricardo Viana[2], Susan Hunter[1]

[1]University of Western Ontario, [2]Parkwood Institute

2-R-93 ***Quantifying stability and asymmetry in individuals with unilateral and bilateral adolescent hip dysplasia during a squatting task***

Alicia Kokoszka[1], Wilshaw Stevens Jr.[1], David Podeszwa[1], Kirsten Tulchin-Francis[1]

[1]Texas Scottish Rite Hospital for Children

T Psychiatric disorders

2-T-94 ***The Assessment of Balance Impairment Using VR in Panic Disorder Patients***

Shani Kimel Naor[1], Revital Amiaz[1], Efrat Czerniak[1], Yotam Bahat[1], Oran Ben-Gal[1], Asaf Caspi[1], Meir Plotnik[1]

[1]Sheba medical center

U Sensorimotor control

2-U-95 ***Moving-light-touch based closed loop control of the centre-of-pressure of a patient with a plexus brachial paralysis***

Wael Bachta[1], Fabien Vérité[1], Philippe Thoumie[2]

[1]Université Pierre et Marie Curie, [2]Hôpital Rothschild

2-U-96 ***Reliance on egocentric frame of reference mediates optic flow influence while stepping in place***

Delphine Bernardin[1], Pauline Bouchar[2], Lauriane Bichot[2], Jocelyn Faubert[2]

[1]Essilor / Universite de Montreal, [2]Universite de Montreal

2-U-97 ***Interaction between proprioception and vision during gait in young healthy adults***

Cyril Duclos[1], Noemie Duclos[1], Agnes Barthelemy[1], Michael Bertrand-Charette[2], Kevin Brunelle-Périard[3], Rebecca Chapman[4], Chesney Craig[5], Charline Dambreville[2], Andrea Cristina de Lima-Pardini[6], Wagner De Souza Silva[7], Lucie Dubreucq[8], Manuel Escalona[9], Sh

[1]Université de Montréal, School of rehabilitation, [2]Universite Laval, [3]Universite-du-Quebec-a-Trois-Rivieres, [4]University of Prince Edward Island, [5]Queen's University Belfast, [6]University of Sao Paulo, [7]McGill University, [8]Center for Interdisciplinary Res

2-U-98 ***Gait stability in negative viscous force fields***

Keith Gordon[1], Mengnan Wu[1], Geoffrey Brown[1], Jane Woodward[2]

[1]Northwestern University, [2]Rehabilitation Institute of Chicago

2-U-99 ***The effect of GVS on path trajectory and body rotation in the absence of visual cues during a spatial navigation task***

Tanya Karn[1], Michael Cinelli[1]

[1]Wilfrid Laurier University

2-U-100 ***Do older adults (mis)judge their physical abilities consistently over stepping tasks?***

Nick Kluft[1], Sjoerd Bruijn[1], Jaap van Dieën[1], Mirjam Pijnappels[1]

[1]VU Amsterdam

2-U-101 ***The use of an "anchor system" tied to the fingertip did not reduce body sway in young adults***

Renato Moraes[1], Bruno Bedo[1], Luciana Santos[1], Rosangela Batistela[1], Paulo Santiago[1], Eliane Mauerberg-deCastro[2]

[1]University of Sao Paulo at Ribeirao Preto, [2]Sao Paulo State University

2-U-102 ***The addition of haptic information of two hands using anchor system and light touch tasks is more effective to reduce body sway than one hand***

Renato Moraes[1], Bruno Bedo[1], Luciana Santos[1], Rosangela Batistela[1], Paulo Santiago[1], Eliane Mauerberg-deCastro[2]

[1]University of Sao Paulo at Ribeirao Preto, [2]Sao Paulo State University

2-U-103 ***Head and neck position sense using a memory-driven joint position matching study: A pilot validation study***

Rebecca Robins[1], Greg Teodoro[1], W. Geoffrey Wright[1]

[1]Temple University

2-U-104 ***Skin sensitivity of the foot sole is altered by posture mediated skin deformation.***

Simone Smith[1], Maiya Yokich[1], Shawn Beaudette[1], Stephen Brown[1], Leah Bent[1]

[1]University of Guelph

2-U-105 ***Influence of light touch on corticospinal excitability of ankle flexor and extensor muscles during quiet standing***

Makoto Takahashi[1], Ryohei Iwamasa[2], Miyuki Miwa[3], Asami Shimizu[4], Masaya Anan[5], Koichi Shinkoda[1]

[1]Hiroshima University, [2]Yasumoto Clinic, [3]Hamawaki Orthopaedic Hospital, [4]Hatano Orthopaedic Hospital, [5]Oita University

V Tools and methods for posture and gait analysis

2-V-106 ***Accelerometer based measurement of balance and gait after treatment for lower extremity musculoskeletal cancer in the clinic: A feasibility and validity study***

Sherron Furtado[1], Alan Godfrey[2], Brook Galna[2], Lynn Rochester[2], Craig Gerrand[3]

[1]Newcastle Upon Tyne Hospitals NHS Foundation Trust, [2]Newcastle University, [3]Newcastle Upon Tyne Hospitals NHS Foundation Trust, Freeman Hospital

2-V-107 ***Gait analysis by newly developed sensor of Mimamori-gait system***

Kazuo Ishikawa[1], Kou Koizumi[2], Kazuhiro Shiina[2], Hiromoto Kimura[1]

[1]Japanese Red Cross, Akita Hospital, [2]Akita Graduate School of Medicine

2-V-108 ***A new clinical test for measuring gait adaptability in children***

Rosanne Kuijpers[1], Ellen Smulders[2], Vivian Weerdesteyn[2]

[1]Department of Rehabilitation, Donders Institute for Brain, Cognition and Behaviour, Radboud University Medical Center, Nijmegen, The Netherlands, [2]Department of Rehabilitation, Donders Institute for Brain, Cognition and Behaviour, Radboud Universi

2-V-109 ***Stitching together short gait trials is not reliable to estimate stride-to-stride dynamics.***

Vivien Marmelat[1], Brandon Bischoff[1], Nicholas Reynolds[1]

[1]University of Nebraska at Omaha

2-V-110 ***Can machines learn how to perform movement analysis?***

Luca Palmerini[1], Lorenzo Chiari[1]

[1]University of Bologna

2-V-111 ***A method for estimating ground reaction forces with limited gait measurements***

Sue(Sukyung) Park[1], Hansol Ryu[1]

[1]Korea Advanced Institute of Science and Technology

2-V-112 ***Validating a skin mounted inertial sensor to measure postural control of people with multiple sclerosis***

Ruopeng Sun[1], Yaejin Moon[1], Kirsten Seagers[2], Nirav Sheth[2], Jacob Sosnoff[1]

[1]University of Illinois at Urbana-Champaign, [2]Mc10 Inc.

2-V-113 ***The reaction time of the postural system***

Philippe Villeneuve[1], Maurice Ouaknine[2], Pierre Marie Gagey[1]

[1]Institut de posturologie, [2]APH Marseille

2-V-114 ***Which is the pertinent feet position for clinical stabilometry?***

Masahiko Yamamoto[1], Tomoe Yoshida[1], Kazuo Ishikawa[2], Eigo Omi[3]

[1]Toho University, [2]Japanese Red Cross Akita Hospital, [3]Akita Kousei Medical Center

2-V-115 ***The Sliding Phenomenon on the Tibial Articular Surface of Femur during Stance Phase***

Hiroyuki Yamamoto[1]

[1]HImeji Dokkyo Unuiversity/Faculty of Health Care Sciences

W Vestibular function and disorders

2-W-116 ***The recurrence quantification analysis of the postural balance for differentiating the patients with vestibular impairment from the healthy subjects.***

Mitsuhiro Aoki[1], Takashi Ichinomiya[1], Hisamitsu Hayashi[1], Keisuke Mizuta[1], Yatsuji Ito[1], Yasutomi Kinosada[1]

[1]Gifu University

2-W-117 ***Effects of noisy vestibular galvanic stimulation on standing up motion balance in older adults***

Osamu Aoki[1], Yoshitaka Otani[2]

[1]Shijonawate Gakuen University, [2]Kobe International University

2-W-118 ***Feasibility and effects of an intensive 1-week day camp program on vestibular function and functional gait in children with Developmental Coordination Disorder (DCD)***

Anouk Lamontagne[1], Elizabeth Dannenbaum[2], Caro-Lyne Bégin[1], Éliane Daigneault-Bourgeois[1], Nancy Kwon Pak Yin[1], Chloé Laferrière-Trudeau[1], Barbara Mazer[1], Virginie Moreau[1], Lora Salvo[2], Myriam Villeneuve[2]

[1]McGill University, [2]Jewish Rehabilitation Hospital

2-W-119 ***Postural Response to a Sudden Released Pulling Force in Patients with Benign Paroxysmal Positional Vertigo***

Pei-Yun Lee[1], Yi-Chun Huang[1], Tzu-Tung Tsai[2], Jiunn-Liang Wu[2], Wei-Ting Lee[3], Sang-I Lin[1], Yi-Ju Tsai[1], Pei-Yun Lee[1]

[1]National Chen Kung University, [2]National Cheng Kung University Hospital, [3]National Chen Kung University Hospital

2-W-120 ***Visual verticality perception after stroke: a systematic review of methodological approaches and suggestions for standardization***

Dominic Pérennou[1], Céline Piscicelli[1]

[1]University Hospital Grenoble-Alpes

X Visual function and disorders

2-X-121 ***Glaucoma, Gait and Attention***

Caitlin O'Connell[1], Gadi Wollstein[2], Ian Conner[1], Rakie Cham[1]

[1]University of Pittsburgh, [2]New York University

Poster Session 3

Thursday, June 29 between 10:30 and 12:30

A Activity monitoring

3-A-1 ***Reliability and validity of Tractivity sensors for monitoring functional ambulation in community-dwelling stroke survivors***

Kedar Deshpande[1], Clive Pai[1], Tanvi Bhatt[1]

[1]University of Illinois at Chicago

3-A-2 ***Turn around freezing and falls: measuring turning at home in Parkinson's disease***

Martina Mancini[1], Aner Weiss[2], Talia Herman[2], Fay Horak [1], Jeff Hausdorff[2]

[1]Oregon Health & Science University, [2]Center for the Study of Movement, Cognition and Mobility, Neurological Institute, Tel Aviv Sourasky

B Adaptation, learning, plasticity and compensation

3-B-3 ***Influence of social evaluative threat during a mathematical anxiety task on standing balance***

Mihalis Doumas[1], Kinga Morsanyi[1]

[1]Queens University Belfast

3-B-4 ***Sway referencing in sitting: visual/vestibular feedback, motor learning, and cognitive influences***

Adam Goodworth[1], Kimberly Tetreault[1], Tate Klidonas[1], Jeffrey Lanman[1], Aissa Mcguirl[1], Ethan Warchol[1], Sandra Saavedra[1]

[1]University of Hartford

3-B-5 ***Does step training in specific directions induce negative transfer effects in untrained directions?***

Yoshiro Okubo[1], Matthew Brodie[1], Jasmine Menant[1], Manasa Udyavar[2], Benjamin Barry[2], Stephen Lord[1], Daina Sturnieks[1]

[1]Neuroscience Research Australia, [2]University of New South Wales

3-B-6 ***Cortical processing underlying split-belt treadmill gait adaptation: an EEG study***

Hikaru Yokoyama[1], Tetsuya Ogawa[1], Kimitaka Nakazawa[1], Noritaka Kawashima[2]

[1]The University of Tokyo, [2]National Rehabilitation Center for Persons with Disabilities

C Aging

3-C-7 ***Effect of Age on Gait Based on Elevation Angles***

Woei-Nan Bair[1], Stephanie Studenski[1]

[1]National Institute on Aging

3-C-8 ***Sensory Reweighting, Muscle Co-contraction and Postural Illusions in Healthy and Fall-prone Older Adults***

Chesney Craig[1], Mihalis Doumas[2]

[1]Manchester Metropolitan University, [2]Queen's University Belfast

3-C-9 ***Normative instrumented straight walking database for an elderly population over 6 years observation time***

Morad Elshehabi[1], Silvia Del Din[2], Sebastian Heinzel[3], Ulrike Suenkel[4], Tanja Schmitz-Hübsch[5], Lynn Rochester[2], Daniela Berg[1], Walter Maetzler[1]

[1]Christian-Albrechts University, Kiel, Germany, [2]Institute of Neuroscience, Clinical Ageing Research Unit, Newcastle University, [3]Neurology Department Christian-Albrechts University, [4]Center for Neurology and Hertie Institute for Clinical Brain Research &

3-C-10 ***Effects of visual input and support-base width on muscle coactivation during standing in the elderly***

Yoshitaka Iwamoto[1], Makoto Takahashi[1], Tomonori Sawada[1], Koichi Shinkoda[1]

[1]Hiroshima University

3-C-11 ***Aging effects on the temporal modification of muscle activation patterns during split-belt treadmill walking***

Claudine Lamoth[1], Danique Vervoort[1], Rob den Otter[1]

[1]University of Groningen, University Medical Centre Groningen

3-C-12 ***The effect of aging on muscle material properties of ankle plantarflexor and dorsiflexor muscles***

Sabrina Lee[1], Ada Terman[1], Ricardo Santana[1], Kristen Jakubowski[1]

[1]Northwestern University

3-C-13 ***Effect of plantar stimulation on postural control in elderly***

Frédéric VISEUX[1], Sébastien Leteneur[2], Franck Barbier[2], Philippe Villeneuve[3]

[1]Laboratory of Industrial and Human Automation control, Mechanical engineering and Computer Science, University of Valenciennes, [2]Laboratory of Industrial and Human Automation control, Mechanical engineering and Computer Science, , [3]Institute of Posturolo

D Biomechanics

3-D-14 ***A bipedal walking simulation using an inverted double pendulum model with a reduced number of body segments***

Toyoyuki Honjo[1], Masahiro Fujimoto[2], Tadao Isaka[2]

[1]National Defense Academy of Japan, [2]Ritsumeikan University

3-D-15 ***The effect of lower extremity peripheral nerve function, hip abduction strength, and one legged balance capacity on elderly motor vehicle driver egress time***

Payam Mirshams Shahshahani[1], Aliaksandra Kapshai[1], Trina DeMott[1], James Richardson[1], Ksenia Kozak[2], Nanxin Wang[2], Jian Wan[2], James Ashton-Miller[1]

[1]University of Michigan-Ann Arbor, [2]Ford Motor Company

3-D-16 ***Reliability of peroneus longus and abductor hallucis electromyography during walking***

Joanna Reeves[1], Christopher Nester[1], Richard Jones[1], Anmin Liu[1]

[1]University of Salford

3-D-17 ***Associations between task performance and trunk coupling during a balance-dexterity task***

K. Michael Rowley[1], James Gordon[1], Kornelia Kulig[1]

[1]University of Southern California

3-D-18 ***Validation of centre of pressure gait event detection in young healthy participants and stroke survivors during target stepping.***

Susanne van der Veen[1], Richard Baker[1], Kristen Hollands[1]

[1]University of Salford

E Brain imaging/activation during posture and gait

3-E-19 ***Associations between leg strength asymmetry and mobility impairment in multiple sclerosis: a case for tDCS?***

Brett Fling[1], Felix Proessl[1], Nathan Ketelhut[1], John Kindred[1], Brach Poston[2], Thorsten Rudroff[1]

[1]Colorado State University, [2]University of Nevada, Las Vegas

3-E-20 ***Reliability of tibialis anterior intramuscular coherence during overground walking in older adults: preliminary findings.***

Federico Gennaro[1], Eling de Bruin[1]

[1]ETH Zurich

3-E-21 ***Postural and Cortical Responses following Visual Occlusion in adults with and without ASD***

KWANG LENG GOH[1], TELE TAN[1], SUSAN MORRIS[1]

[1]CURTIN UNIVERSITY

3-E-22 ***A comparison of the neural correlates of complex walking in healthy young adults and middle-aged adults during real locomotion***

Trina Mitchell[1], Faryn Starrs[2], Caroline Paquette[2]

[1]McGill University, Centre for Interdisciplinary Research in Rehabilitation of Greater Montreal (CRIR), [2]McGill University, Centre for Interdisciplinary Research in Rehabilitation of Greater Montreal (CRIR

3-E-23 ***Neural Control of Anticipatory Postural Adjustments***

Angel Phanthanourak[1], Craig Tokuno[1]

[1]Brock University

3-E-24 ***Activation of the supplementary motor area differentiates between preparation of compensatory balance responses with stepping and feet-in-place strategies***

Vivian Weerdesteyn[1], Teodoro Solis-Escalante[2], Joris van der Cruijsen[2], Digna de Kam[1], Joost van Kordelaar[3], Alfred Schouten[2]

[1]Radboud University Medical Centre, [2]Delft University of Technology, [3]University of Twente

F Cognitive impairments

3-F-25 ***The interaction of cholinergic activity, gait, balance, and attention in mild cognitive impairment***

Douglas Martini[1], Katrijn Smulders[1], Spencer Smith[1], Joseph Quinn[1], Fay Horak[1]

[1]Oregon Health and Science University

3-F-26 ***Gait impairment in Dementia with Lewy bodies: A useful clinical biomarker?***

Ríona Mc Ardle[1], Brook Galna[1], Alan Thomas[1], Lynn Rochester[1]

[1]Newcastle University

G Cognitive, attentional, and emotional influences

3-G-27 ***Effect of Speed and Age on Cognitive Motor Interference during Walking***

Yashashree Apte[1], Prakruti Patel[1], Tanvi Bhatt[1]

[1]University of Illinois at Chicago

3-G-28 ***The Attentional Demands of Haptic Modalities during Overground Walking***

Aaron Awdhan[1], Joel Lanovaz[1], Catherine Arnold[1], Marla Mickleborough[1], Alison Oates[1]

[1]University of Saskatchewan

3-G-29 ***Defining approach/avoidance in whole-body behavior***

Daniëlle Bouman[1], John Stins[1], Peter Beek[1]

[1]MOVE Research Institution

3-G-30 ***The Effects of Task Priority on Postural-suprapostural Task in Elderly Adults and Early-stage Parkinson's Disease***

Liang-Chi Chen[1], Shu-Han Yu[2], Yu-Ting Hung[1], Cheng-Ya Huang[1]

[1]National Taiwan University, Taipei, Taiwan, [2]National Taiwan University Hospital, Taipei, Taiwan.

3-G-31 ***Exploring the relationship between threat-related changes in attention processing and postural control***

Kyle Johnson[1], Martin Zaback[2], Craig Tokuno[1], Mark Carpenter[2], Allan Adkin[1]

[1]Brock University, [2]University of British Columbia

3-G-32 ***The influence of unexpected perturbations during standing and walking on the performance of a concurrent cognitive task among young adults***

Inbal Paran[1], Inbal Paran[1], Itshak Melzer[1]

[1]Ben-Gurion University, Israel

H Coordination of posture and gait

3-H-33 ***Proprioceptive signals dominate control of postural sway in healthy older adults until vestibular signals become the most reliable***

Eric Anson[1], Robin Bigelow[1], Bonnielin Swenor[1], Nandini Deshpande[2], Stephanie Studenski[3], John Jeka[4], Yuri Agrawal[1]

[1]Johns Hopkins School of Medicine, [2]Queens University, [3]Longitudinal Studies Section, National Institute on Aging, [4]Temple University

3-H-34 ***Body weight support training and movement coordination during walking on different surfaces in individuals with stroke***

Melissa Celestino[1], Gabriela Gama[1], Ana Maria Barela[1], Richard van Emmerik[2]

[1]Curzeiro do Sul University, [2]University of Massachusetts

3-H-35 ***Determining which action strategy individuals use to walk through misaligned apertures***

Michael Cinelli[1], Amy Hackney[2], James Frank[2]

[1]Wilfrid Laurier University, [2]University of Waterloo

3-H-36 ***Feasibility of using dynamical system's analyses to observe gait coordination ability in hemiplegic cerebral palsy***

Brian Cone[1]

[1]University of North Carolina at Greensboro

3-H-37 ***Is Faster Always Better? A Description of How Temporal Gait Asymmetry Changes with Increased Walking Speed Following Stroke***

Lucas Crosby[1], Elizabeth Inness[2], Jennifer Wong[2], Svetlana Knorr[2], Avril Mansfield[2], Kara Patterson[1]

[1]University of Toronto, [2]Toronto Rehabilitation Institute - University Health Network

3-H-38 ***Lower-limb joints stabilize trailing toe height during repeated obstacle crossing***

Chuyi Cui[1], Shirley Rietdyk[1], Satyajit Ambike[1]

[1]Purdue University

3-H-39 ***Influence of Age and Physical Activity on the Fractal Structure of Postural Center of Pressure***

Scott Ducharme[1], Joshua Liddy[2], Richard van Emmerik[1]

[1]University of Massachusetts, Amherst, [2]Purdue University

3-H-40 ***Sleep Deprivation and Balance - Is it time to wake up?***

Ilan Kurz[1], Shani Berkowitz[2], Itzhak Meltzer[2]

[1]Schwartz Movement Analysis and Rehabilitation Laboratory, Physical Therapy Department, Recanati Scho, [2]Department of Physical Therapy, Faculty of Health Sciences, Ben-Gurion University of the Negev, Beer

3-H-41 ***Gaze-body coordination during overground locomotion and avoidance of virtual human-like avatars***

Anouk Lamontagne[1], Anouk Lamontagne[1]

[1]Jewish rehabilitation hospital and McGill University

3-H-42 ***The ability to switch anticipatory locomotor adjustments in accordance with environmental and time constraints***

Bradford McFadyen[1], Caroline Charette[2], Felix Fiset[1]

[1]Laval University, [2]CIRRIS

3-H-43 ***Are the characteristics of a human obstacle transferable to virtual reality during aperture crossing?***

Lana Pfaff[1], Michael Cinelli[1]

[1]Wilfrid Laurier University

3-H-44 ***Increase in walking speed leads to faster reaction time in older adults***

Natalie Richer[1], Nadia Polskaia[1], Benjamin Raymond[1], Yves Lajoie[1]

[1]University of Ottawa

3-H-45 ***Gait coordination in acute myelopathy patients before and after gait treatment using a powered exoskeleton***

Puentes Sandra[1], Hideki Kadone[2], Aiki Marushima[3], Shigeki Kubota[4], Yukiyo Shimizu[5], Hiroaki Kawamoto[1], Kenji Suzuki[6], Tetsuya Abe[7], Masashi Yamazaki[1]

[1]Faculty of Engineering, Information and Systems, University of Tsukuba, [2]Center for Innovating Medicine and Engineering (CIME), University of Tsukuba, [3]Department of Neurosurgery, Faculty of Medicine, University of Tsukuba, [4]Department of Orthopaedic Sur

3-H-46 ***Characteristics of collision avoidance strategy during locomotion: effect of the obstacle position and direction of avoidance***

Kotaro Shimizu[1], Taketo Furuna[2]

[1]Sapporo Medical University, [2] Sapporo Medical University

3-H-47 ***Walking adaptability training in people after stroke: a randomized controlled trial***

Celine Timmermans[1], Melvyn Roerdink[1], Marielle Van Ooijen[1], Carel Meskers[2], Peter Beek[1], Thomas Janssen[1]

[1]Vrije Universiteit, [2]VU Medical Center

3-H-48 ***Key spatiotemporal components of gait in children who are preschoolers***

Evi Verbecque[1], Luc Vereeck[1], Paul Van de Heyning[1], Ann Hallemans[1]

[1]University of Antwerp

3-H-49 ***Neuromuscular organization during balance-correcting responses induced with platform-translation and shoulder-pull perturbation methods***

Dmitry Verniba[1], William Gage[1]

[1]York University

3-H-50 ***A Multicenter Study Evaluating Balance Control During Dual-Task Walking in Adolescent Athletes Following Concussion***

Tishya Wren[1], Matthew Solomito[2], Regina Kostyun[2], Yan-Husn Wu[1], Nicole Mueske[1], Tracy Zaslow[1], Li-Shan Chou[3], Sylvia Ounpuu[2]

[1]Children's Hospital Los Angeles, [2]Connecticut Children's Medical Center, [3]University of Oregon

J Devices to improve posture and gait

3-J-51 ***A mathematical model of cane assisted upright human balance***

James Chagdes[1], Amit Shukla[1]

[1]Miami University

3-J-52 ***Differential effects of cueing and feedback on gait and fatigue in people with Parkinson's disease***

Pieter Ginis[1], Elke Heremans[1], Nicholas D'Cruz[1], Alberto Ferrari[2], Colleen Canning[3], Alice Nieuwboer[1]

[1]KU Leuven, [2]University of Bologna, [3]University of Sydney

3-J-53 ***Effects of muscle vibration on gait initiation in Parkinson's disease with and without Freezing of Gait***

Marcelo Pereira[1], Paulo H Pelicioni[2], Quincy Almeida[3], Lilian T Gobbi[4]

[1]Posture and Locomotion Studies Laboratory - São Paulo State University (Unesp), Institute of Biosciences, [2]University of New South Wales, [3]Wilfried Laurier University, [4]Posture and Locomotion Studies Laboratory - São Paulo State University (Unesp), Insti

K Effect of medication on posture and gait

3-K-54 ***Effect of medication on habitual gait in people with Parkinson's disease: a feasibility study.***

Silvia Del Din[1], Michael Dunne-Willows[1], Alan Godfrey[1], Jian Shi[1], Shirley Coleman[1], David Burn[1], Lynn Rochester[1]

[1]Newcastle University

M Exercise and physical activity

3-M-55 ***Daily Bicycling in Older Adults is Effective to Reduce Fall Risks - a Case Control Study***

shani batcir[1], Itshak Melzer[1]

[1]Faculty of Health Sciences, Ben-Gurion University of the Negev, Beer-Sheva, Israel

3-M-56 ***Responders to a highly challenging balance training in Parkinson's disease***

Erika Franzén[1], Niklas Löfgren[1], David Conradsson[1], Breiffni Leavy[1], Maria Hagströmer[1]

[1]Karolinska Institutet

3-M-57 ***Changes in physical activity during hospital stay for patients after stroke***

Ole Petter Norvang[1], Anne Hokstad[2], Kristin Taraldsen[3], Xiangchun Tan[3], Torunn Askim[3]

[1]St Olavs University Hospital, [2]Betania Malvik, [3]Norwegian University of Science and Technology

3-M-58 ***Physiological and perceived exertion responses to a novel walking exercise, "i-Walk"***

Kento Shimoho[1], Takahiro Tanaka[1], Masahiro Fujimoto[1], Toyoyuki Honjo[2], Masafumi Terada[1], Tadao Isaka[1]

[1]Ritsumeikan University, [2]National Defense Academy of Japan

N Falls and fall prevention

3-N-59 ***Pre-impact fall detection and the development of a hip protection air bag system***

Soonjae Ahn[1], Eunkyoung Choi[1], Jongman Kim[1], Inhyuk Moon[2], Youngho Kim[1]

[1]Yonsei University, [2]Dong-Eui University

3-N-60 ***Catch-the-ruler: Measuring response inhibition in healthy older fallers and non-fallers using the ReacStick test***

Kim Delbaere[1], Maike Visschedijk[2], Mirjam Pijnappels[2], James Richardson[3], Stephen Lord[1]

[1]University of New South Wales, [2]VU University Amsterdam, [3]University of Michigan

3-N-61 ***Walking-adaptability assessments with the Interactive Walkway: Between-systems agreement and sensitivity to task and subject variations***

Daphne Geerse[1], H. Coolen[1], M. Roerdink[1]

[1]MOVE Research Institute Amsterdam

3-N-62 ***Failures in adaptive locomotion: Knowledge of obstacle contact is instrumental to guide limb trajectory***

Michel Heijnen[1], Shirley Rietdyk[2]

[1]University of North Carolina Wilmington, [2]Purdue University

3-N-63 ***Validating Virtual Time to Contact with Home-Based Technology***

Katherine Hsieh[1], Yaejin Moon[1], Vignesh Ramkrishnan[2], Rama Ratnam[1], Jacob Sosnoff[1]

[1]University of Illinois at Urbana Champaign, [2]Illinois at Singapore

3-N-64 ***Brake and loading impulse characteristics when responding to a forward loss of balance in people with stroke***

Andrew Huntley[1], Elizabeth Inness[1], Anthony Aqui[1], George Mochizuki[2], Avril Mansfield[1]

[1]Toronto Rehabilitation Institute - University Health Network, [2]Sunnybrook Research Institute

3-N-65 ***Falls in cerebellar ataxia: causes and predictability***

Klaus Jahn[1], Cornelia Schlick[1], Max Wuehr[1], Roman Schniepp[1]

[1]University of Munich

3-N-66 ***A Study on Fall Prediction Using the Linear/Nonlinear Analysis of Postural Sway in the Elderly***

DongWon Kang[1], JeongWoo Seo[1], JinSeung Choi[1], GyeRae Tack[1]

[1]Konkuk University

3-N-67 ***Instrumented assessment of wheeled walker use in geriatric rehabilitation patients***

Jochen Klenk[1], Felix Buhnar[1], Clemens Becker[1], Ulrich Lindemann[1]

[1]Robert-Bosch Hospital

3-N-68 ***A cross-sectional study of set shifting impairments and falling in individuals with and without Parkinson's disease***

J. Lucas McKay[1], Kimberly Lang[2], Lena Ting[1], Madeleine Hackney[3]

[1]Emory University and Georgia Tech, [2]Emory University, [3]Emory University / Atlanta VAMC

3-N-69 ***Restrictive trunk postural strategy when walking identifies fallers but not freezers***

Julie Nantel[1], Catherine Fréchette[1]

[1]University of Ottawa

3-N-70 ***Fall incidence and associated risk factors among people with a lower limb amputation during various stages of recovery - a systematic review***

Meir Plotnik[1], Amihai Gottlieb[1], Noam Steinberg[2], Itzhak Siev-Ner[1]

[1]Sheba Medical Center, [2]Tel Aviv University

3-N-71 ***Support leg muscle activity during online adjustments of trip recovery***

Zrinka Potocanac[1], Mirjam Pijnappels[2], Jaap van Dieën[2], Jacques Duysens[3]

[1]Jozef Stefan Institute, [2]MOVE Research Institute Amsterdam, VU University Amsterdam, [3]KU Leuven

3-N-72 ***Gait perturbations to discriminate between older adults with and without history of falls***

Sanne Roeles[1], Philip Rowe[1], Sjoerd Bruijn[2], Craig Childs[1], Georgia Tarfali[1], Frans Steenbrink[1], Mirjam Pijnappels[2]

[1]University of Strathclyde, [2]VU University Amsterdam

3-N-73 ***Merging virtual reality and post-stroke fractal gait rehabilitation***

Ruth Stout[1], Christopher Rhea[1]

[1]UNC-Greensboro

3-N-74 ***Circumstances of imbalance leading to falls during sit-to-stand transfers in older adults***

Kimberley van Schooten[1], Stephen Robinovitch[1]

[1]Simon Fraser University

3-N-75 ***Evidence from Video Capture of the Characteristics of Falls Leading to Hip Fracture in Older Adults in Long-Term Care***

Yijian Yang[1], Bryan Lo[2], Alexandra Korall[2], Stephen Robinovitch[2]

[1]University of British Columbia, [2]Simon Fraser University

O Habilitation & rehabilitation

3-O-76 ***Modification of the temporal gait asymmetry between laboratory and community environments in post-stroke individuals: preliminary results***

Noémie Duclos[1], Gerald Parent[2], Larissa Aguiar[1], Rachid Aissaoui, Cyril Duclos[1], Sylvie Nadeau[1]

[1]Université de Montréal, Center for Interdisciplinary Research in Rehabilitation, [2]Centre de Recherche du Centre Hospitalier Universitaire de Montréal

3-O-77 ***Does functional electrical stimulation have greater therapeutic effects on walking than ankle foot orthoses for foot-drop?***

Kristen Hollands[1], Sarah Prenton[2], Pornsuree Onmannee[1], Laurence Kenney[1]

[1]University of Salford, [2]University of Huddersfield

3-O-78 ***Increased neural activity in the motor areas after robotic gait training in stroke patients***

Noel Keijsers[1], Eliana Garcia-Cossio, Peter Desain[2], Jaak Duysens[1], Jason Farquhar[2]

[1]Sint Maartenskliniek, [2]Radboud University

3-O-79 ***In sync with the groove: How is synchronization accuracy altered by cue pace and perceived groove during rhythmic auditory stimulation?***

Emily Ready[1], Lucy McGarry[1], Jeffrey Holmes[1], Jessica Grahn[1]

[1]University of Western Ontario

3-O-80 ***Multi-session transcranial direct current stimulation (tDCS) improves the physiologic complexity of dual-task postural control in functional-limited older adults***

Junhong Zhou[1], Lewis Lipsitz[1], Brad Manor[1]

[1]Havard Medical School

Q Neurological diseases

3-Q-81 ***Effect of obstacle contrast on visual behaviour in Parkinson's disease***

Lisa Alcock[1], Brook Galna[1], Jeffrey Hausdorff[2], Lynn Rochester[1]

[1]Newcastle University Institute for Ageing, Newcastle University, [2]Neurological Institute, Tel Aviv Sourasky Medical Center

3-Q-82 ***The effects of transcranial direct current stimulation on gait initiation in people after stroke***

Milou Coppens[1], Pauline Hermans[1], Jorik Nonnekes[1], Alexander Geurts[1], Vivian Weerdesteyn[1]

[1]Radboud University Medical Center

3-Q-83 ***The Turning Point: Dynamic stability in people with Parkinson's disease***

Carolin Curtze[1], Spencer Smith[1], Peter Fino[1], Patricia Carlson-Kuhta[1], John Nutt[1], Fay Horak[1]

[1]Oregon Health & Science University

3-Q-84 ***The effects of a cognitive dual-task on reactive postural control in people with Parkinson's disease***

Bauke Dijkstra[1], Surendar Devan[1], Esther Bekkers[1], Kim Dockx[1], Elke Heremans[1], Sabine Verschueren[1], Alice Nieuwboer[1]

[1]University of Leuven

3-Q-85 ***The Spatiotemporal Gait Adjustments during a Virtual Obstacle Crossing Task in Adults with Diabetes***

Chun-Kai Huang[1], Vijay Shivaswamy[1], Pariwat Thaisetthawatku[1], Lynn Mack[1], Ka-Chun Siu[1]

[1]University of Nebraska Medical Center

3-Q-86 ***Evaluation and implementation of highly challenging balance training in clinical practice for people with Parkinsons disease: protocol for the HiBalance effectiveness-implementation trial***

Breiffni Leavy[1], Lydia Kwak[1], Maria Hagströmer[1], Erika Franzén[1]

[1]Karolinksa Institutet

3-Q-87 ***Effect of botulinum toxin-A injections for spasticity management on volitional and compensatory stepping***

George Mochizuki[1], Chris Boulias[2], Ellen Cohen[1], Will Gage[3], Farooq Ismail[2], Avril Mansfield[4], Kara Patterson[5], Chetan Phadke[2], Satyendra Sharma[6], Jonathan Singer[7]

[1]Sunnybrook Research Institute, [2]West Park Healthcare Centre, [3]York University, [4]Toronto Rehabilitation Institute, [5]University of Toronto, [6]Sunnybrook Health Sciences Centre, [7]University of Manitoba

3-Q-88 ***Obstacle height or quantity: which causes more gait adaptations during approach phase in Parkinson's disease?***

Diego Orcioli-Silva[1], Fabio Barbieri[2], Paulo Santos[1], Victor Beretta[1], Lucas Simieli[2], Rodrigo Vitório[1], Lilian Gobbi[1]

[1]São Paulo State University (Unesp), Institute of Biosciences, Rio Claro, Brazil., [2]São Paulo State University (Unesp), School of Sciences, Bauru, Brazil

3-Q-89 ***What is the relation between Unilateral Spatial Neglect and biases in Verticality perception after stroke?***

Dominic Pérennou[1], Marie Jaeger[2], Celine Piscicelli[1], Anne Chrispin[1], Patrice Davoine[1], Eve Eve Dupierrix[1]

[1]University Hospital and University Grenoble-Alpes, [2]University Hospital Grenoble-Alpes

3-Q-90 ***Do Individuals with Parkinson's Disease Initiate or Suppress Unintentional Saccade Eye Movements to Incoming Visual Stimuli?***

Rebecca Reed-Jones[1], Rebecca Chapman[1], Tyler Baker[1]

[1]University of Prince Edward Island

3-Q-91 ***Time course of gait improvement in patients with idiopathic normal pressure hydrocephalus after lumbar puncture over 72 hours***

Roman Schniepp[1], Max Wuehr[1], Ken Moehwald[1], Klaus Jahn[2], Roman Schniepp[1]

[1]Ludwig-Maximillians Universität München, [2]Schön Klinik

3-Q-92 ***Subthalamic deep brain stimulation frequency differentially modulates motor and cognitive control of gait initiation in PD patients***

Pasquale Varriale[1], Antoine Collomb-Clerc[2], Angèle Van Hamme[1], Anaik Perrochon[3], Hayat Belaid[4], Gilles Kemoun[3], Carine Karachi[4], Marie-Laure Welter[2]

[1]Institut du Cerveau et de la Moelle Epinière/CNRS UMR 7225/INSERM 1127/UPMC UM75, Paris, [2]Institut du Cerveau et de la Moelle Epinière/CNRS UMR 7225/INSERM 1127/UPMC UM75, Paris; Fédération , [3]Laboratoire Mobilité, Mouvement et Exercice, [4]Institut du Cer

R Orthopedic diseases and injuries

3-R-93 ***MoCA Item Score Analysis and Relationship to Rehabilitation Outcomes in Lower Extremity Amputees***

Courtney Frengopoulos[1], Michael Payne[2], Ricardo Viana[2], Susan Hunter[1]

[1]University of Western Ontario, [2]Parkwood Institute

3-R-94 ***A Computational Algorithm of Whole Spine Posture Tracking for the Gait Analysis of Patients with Spine-Related Disease***

Chiara Piezzo[1], Hideki Kadone[1], Kousei Miura[1], Tetsuya Abe[1], Kenji Suzuki[1], Masashi Yamazaki[1]

[1]University of Tsukuba

T Psychiatric disorders

3-T-95 ***Lower extremity kinetics during gait in individuals with bipolar disorder***

Gu Eon Kang[1], Brian Mickey[2], Melvin McInnis[1], Melissa Gross[1]

[1]University of Michigan, [2]University of Utah

U Sensorimotor control

3-U-96 ***Action reprogramming in stepping movements: focal versus postural actions***

Claudia Barthel[1], Elizabeth Mallia[2], John Rothwell[2], Bastiaan Bloem[3], Vivian Weerdesteyn[4]

[1]Radboud university medical centre, Donders Centre for Neuroscience, Department of Neurology, Nijmegen, The Netherlands, [2]Sobell Department for Motor Neuroscience and Movement Disorders, Institute of Neurology, University , [3]Radboud university medical cen

3-U-97 ***The effects of foot cooling on muscle responses to a loss of balance***

Oran Ferguson[1], Craig Tokuno[1]

[1]Brock University

3-U-98 ***The effects of multidirectional balance impairments on an aperture crossing task***

Evan Gilbert[1], Michael Cinelli[1]

[1]Wilfrid Laurier University

3-U-99 ***The effects of body tilt in the roll plane on upper limb pointing movements***

Tani Keisuke[1], Yoshihide Shiraki[1], Shinji Yamamoto[2], Yasushi Kodaka[3], Keisuke Kushiro[1]

[1]Kyoto University, [2]Osaka University of Health and Sport sciences, [3]National Institute of Advanced Industrial Science and Technology

3-U-100 ***Can the older adult who over-or underestimate their gait ability be identified?***

Nick Kluft[1], Jaap van Dieën[1], Mirjam Pijnappels[1]

[1]VU Amsterdam

3-U-101 ***An Investigation of the Relationship between Segmental Orientation, Dynamic Stability, and Hearing in Younger and Older Adults with Good Hearing***

Sin-Tung Lau[1], Jennifer Campos[2], Michael Cinelli[3]

[1]Wilfrid Laurier University; Toronto Rehabilitation Institute - University Health Network, [2]Toronto Rehabilitation Institute - University Health Network, [3]Wilfrid Laurier University

3-U-102 ***Gaze and the visual control of foot placement when walking over real-world rough terrain***

Jonathan Matthis[1], Mary Hayhoe[1]

[1]University of Texas at Austin

3-U-103 ***The effects of peripheral visual information on an aperture crossing task in previously concussed, asymptomatic individuals***

Alyssa Prangley[1], Michael Cinelli[1]

[1]Wilfrid Laurier University

3-U-103 ***The effects of peripheral visual information on an aperture crossing task in previously concussed, asymptomatic individuals***

Alyssa Prangley[1], Michael Cinelli[1]

[1]Wilfrid Laurier University

3-U-104 ***Phase-dependency of the balance response to Galvanic vestibular stimulation during walking***

Hendrik Reimann[1], Tyler Fettrow[1], John Jeka[1]

[1]Temple University

3-U-105 ***Phase- and speed-dependent modulation of vestibular contributions to balance control during walking***

Max Wühr[1], Roman Schniepp[1], Haike Dietrich[1]

[1]Ludwig-Maximilians-University Munich

3-U-106 ***Influence of visual dependence on muscle synergy responses to visual and support surface perturbation in cerebral palsy***

Yawen Yu[1], Carole Tucker[1], Richard Lauer[1], Emily Keshner[1]

[1]Temple University

V Tools and methods for posture and gait analysis

3-V-107 ***The Gait Variability Index is robust across differing over ground testing protocols in healthy young adults***

Chitra Balasubramanian[1], Arnaud Gouelle[2]

[1]University of North Florida, [2]Gait and Balance Academy

3-V-108 ***Validity and Reliability of the Re-Step to measure stride time in healthy adults***

Simona Bar-Haim[1], Simona Bar-Haim[1]

[1]Ben-Gurion University

3-V-109 ***Validation of Walking Episode Recognition in Supervised and Free-living Conditions Using Triaxial Accelerometers***

Nethra Ganesh Chigateri[1], Ngaire Kerse[1], Bruce MacDonald[1], Jochen Klenk[2]

[1]The University of Auckland, [2]Robert-Bosch Hospital

3-V-110 ***Measurement Properties of the Community Balance and Mobility Scale in Young-Older Adults***

Katharina Gordt[1], Michaela Weber[1], Jeanine Van Ancum[2], Ronny Bergquist[3], Kristin Taraldsen[3], Andrea Maier[4], Jorunn Helbostad[3], Clemens Becker[5], Michael Schwenk[1]

[1]Network Aging Research, [2]VU University Amsterdam, [3]Norwegian University of Science and Technology, [4]University of Melbourne, [5]Departement of Geriatric Rehabilitation

3-V-111 ***Validity of the Hilbert-Huang Method for Tremor Removal When Quantifying Sway in Patients with Parkinson's Disease***

Jeffrey Hausdorff[1], Talia Herman[1], Marina Brozgol[1], Nir Giladi[1], Anat Mirelman[1], Jeffrey Hausdorf[1]

[1]Tel Aviv Sourasky Medical Center

3-V-112 ***Improved prediction of falls in community-dwelling older adults through phase-dependent irregularity of daily-life walking***

Espen Alexander Ihlen[1], Kimberley Van Schooten[2], Sjoerd Bruijn[3], Jaap van Dieën[3], Beatrix Vereijken[1], Jorunn Helbostad[1], Mirjam Pijnappels[3]

[1]Norwegian University of Science and Technology, [2]Simon Fraser University, [3]VU University

3-V-113 ***Clinically Usable System Identification Method for Human Standing Balance***

Jae Lee[1], Kai Fok[1], Hossein Rouhani[1], Kei Masani[1]

[1]Toronto Rehabilitation Institute

3-V-114 ***Quantitative gait measures during the 6 minutes walk test in lower limb amputees: preliminary results***

Ludovic Miramand[1], Sarah Beausoleil[1], Bradford McFadyen[1], Turcot Katia[1]

[1]Université Laval - CIRRIS

3-V-115 ***Nonlinear analysis of postural stability in people with Parkinson's disease***

Annette Pantall[1], Silvia Del Din[1], Lynn Rochester[1]

[1]Newcastle University

W Vestibular function and disorders

3-W-116 ***Effects of Vestibular Training on Postural Control among Healthy Adults***

Kwadwo Appiah-Kubi[1], W. Geoffrey Wright[2]

[1]Temple, [2]Temple University

3-W-117 ***Does use of intratympanic gentamicin before vestibular schwannoma surgery improve compensation***

Ondrej Cakrt[1], Zdenek Cada[2], Krystof Slaby[1], Jaroslav Jerabek[1]

[1]2nd Faculty of Medicine, Charles University in Prague and Motol University Hospital, Czech Republic , [2]1st Faculty of Medicine, Charles University in Prague and Motol University Hospital, Czech Republic

3-W-118 ***Vestibular modulation of phantom limb pain after supracondylar amputation. A pilot study.***

Kathrine Jáuregui-Renaud[1], Catalina Aranda-Moreno[1], Jaime Reyes-Espinoza[1], Ana Bastida Segura[1], Angelina Andrade-Galicia[1]

[1]Instituto Mexicano Del Seguro Social

3-W-119 ***Effects of Monocular Visual Cues on the Vestibular Control of Standing Balance***

Jacob Kysar[1], Brian Dalton[2]

[1]University of Oregon, [2]University of British Columbia

3-W-120 ***Balance Performance during Turning in Patients with Benign Paroxysmal Positional Vertigo***

Pei-Yun Lee[1], Yi-Chun Huang[1], Tzu-Tung Tsai[1], Jiunn-Liang Wu[1], Wei-Ting Lee[1], Yi-Ju Tsai[1], Sang-I Lin[1]

[1]National Cheng Kung University

3-W-121 ***Differential Effects of Vision Upon the Accuracy and Precision of Vestibular-Evoked Balance Responses***

Stuart Mackenzie[1], Raymond Reynolds[1]

[1]University of Birmingham

X Visual function and disorders

3-X-122 ***Comparison of traditional eye movement exercises with a novel oculomotor training paradigm using a head-mounted virtual reality device***

Fernando Santos[1]

[1]Temple University

EXHIBITOR PROFILES

APDM — Booth 10

APDM produces the highest quality wearable sensors on the market, used by hundreds of universities, hospitals, and professional sports teams worldwide. Our most popular system is a full body gait and balance analysis system, called Mobility Lab.

apdm.com

Bertec — Booth 5

Bertec Corporation is a world leader that manufactures force measuring instruments that include force plates, balance plates, load cells, instrumented treadmills with virtual reality and custom transducers. Customers use Bertec products for research, rehabilitation and sports science.

www.bertec.com

CIR Systems/GAITRite — Booth 16

GAITRite®, 25 years the proven solution for Portable Gait Analysis and the Gold Standard for temporal spatial gait analysis worldwide. GAITRite®'s CLASSIC electronic walkway can be laid over any flat surface with set up time under 2 minutes, for quick and easy automated data collection. Multiple report/export options plus synchronization with external data capture systems. The system supports 2 cameras (60fps available), can be used with/ without assistive devices. GAITRite® RE has a totally smooth top.

www.gaitrite.com

Cometa Systems — T04

Cometa Systems is an Italian company specialised in the design, production and marketing of wireless biomedical devices. Our EMG and IMU sensors are the smallest in the world, medically certified, and the only ones to be 100% waterproof. From integration with motion capture systems, to standalone applications, they have been widely present in the market for over 10 years. Several recent partnerships have allowed us to integrate different software packages, both for EMG and biomechanics analysis.

www.cometasystems.com

Delsys, Inc. — Booth 3

Delsys is a world leader in the design, manufacture, and marketing of a broad portfolio of high performance Electromyography instruments, range of physiological and biomechanical sensors used in virtually all types of movement measurement studies in research and education. Since our inception in 1993, we have focused on solving the engineering challenges associated with wearable EMG sensors such as low signal artifact, low cross-talk, signal reliability and signal consistency while retaining ease-of-use in any environment. We currently market a wide range of innovative products-including wired and wireless physiological and biomechanical sensors, amplifiers and software solutions.

www.delsys.com

Idoneus Digital — T05

Providing unique games and animation to engage patients and improve patient experience in gait labs. Additionally our software platform gives us a unique ability to create custom projects for research, therapy and performance that utilize the latest games technology. Simply bring us your idea and we can build it quickly, simply, and cost effectively.

idoneusdigital.com

Motekforce Link — Booth 17/18

Motekforce Link is the global leader in Virtual Reality technology for rehabilitation and research of orthopedic and neurological disorders. We offer solutions for balance-control, real-time gait analysis and gait training. Our expertise lies in system integration and real-time feedback on human performance, using interactive and dynamic Virtual Reality systems. Come visit us at our booth and try the C-Mill, our system for research, gait analysis, gait training and improving balance.

www.motekforcelink.com

Motion Lab Systems, Inc Booth 14

We offer the only real-time, multi-channel EMG systems with FDA 510(k) clearance for clinical electromyography. Suitable for clinical and research, our systems have the highest bandwidth, and lowest delay, compared to any multi-channel EMG system on the market. Systems are supplied with full C3D support for maximum compatibility. Why compensate for a signal delay when you can use a real-time EMG system with better performance at a competitive price? Now featuring zero-delay radio-telemetry as an option, we include as standard, features that other manufacturers sell as extras.

www.motion-labs.com

novel inc T02

novel is quality in force distribution measurement. novel provides a variety of systems including the emed barefoot pressure platform, the pedar in-shoe pressure measurement system, the pedoped mobile force in-shoe sensor, and the pliance system for applications such as hand, socket-limb pressures, and much more. novel utilizes fully calibrated capacitive sensor technology providing the most accurate data available. Real-time wireless (pedoped, pedar and pliance) display of the calibrated data makes the system perfect for feedback applications during rehabilitation. The pedoped force sensor is captured to a smartphone for real-time feedback during rehabilitation and daily activities.

www.novelusa.com

PAL Technologies Ltd Booth 4

We have developed discrete body-worn sensors to characterise free-living behaviour and lower-limb placement during everyday activities over extended periods. With the ability to provide easily understood metrics to the wearer, these free-living measurement tools also provide researchers with objective measures of patient performance in the home and community, facilitating patient and carer engagement in the rehabilitation process.

www.paltechnologies.com

ProtoKinetics Gait Analysis Walkways Booth 9/Booth 12

The Zeno Electronic Walkway powered by PKMAS software has become the most popular 'gait mat' technology in the world. Capture balance, walking, running, jumping, turning, sit-to-stand, TUG, etc. According to the literature, more falls occur during transitional movements than during straight-line walking. Postural control, dynamic balance, and transitional gait performance [starting, turning, braking] are critical components to quantify in clinical practice.

protokintics.com

Qualisys T03

Qualisys is a leading provider of motion capture technology and has a long history of supplying research, engineering and sports facilities with high-end camera systems and expertise in capturing and analyzing movements. Qualisys offers a wide range of products and services and has offices in Gothenburg, Chicago and Shanghai. Our customers are found in the biomechanical research, sports biomechanics, and medical sectors. Qualisys supplements sports injury, rehabilitation, and private practice clinics with running, gait, & movement analysis tools in Motion Capture. We are recognized by our high performance hardware and user-friendly software, guiding patients from trial to report in minutes

www.qualisys.com

Tekscan Booth 13

Tekscan manufactures a range of pressure assessment and clinical/research evaluation tools. Our unique systems use thin, flexible, high-resolution sensors to observe gait abnormalities, determine treatment efficacy, study joint function, and more.

www.tekscan.com

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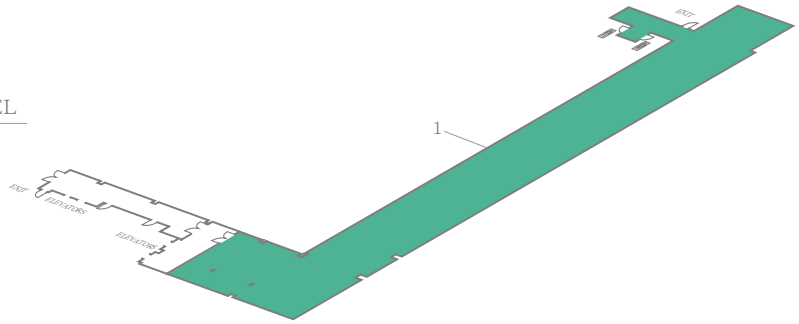
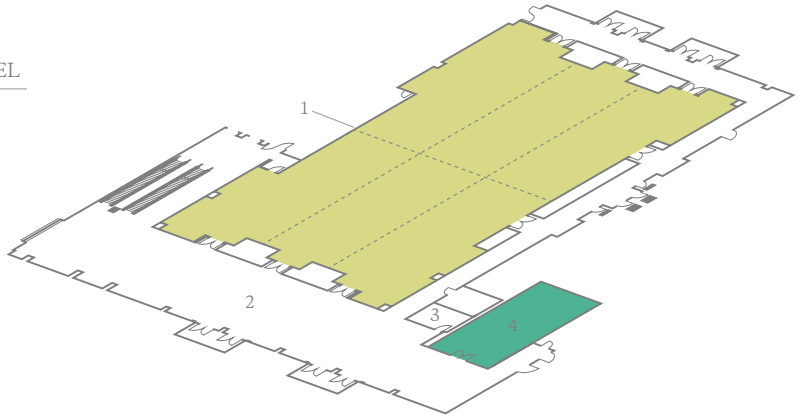
CONVENTION CENTER, ROOFTOP LEVEL

1. SKY TERRACE



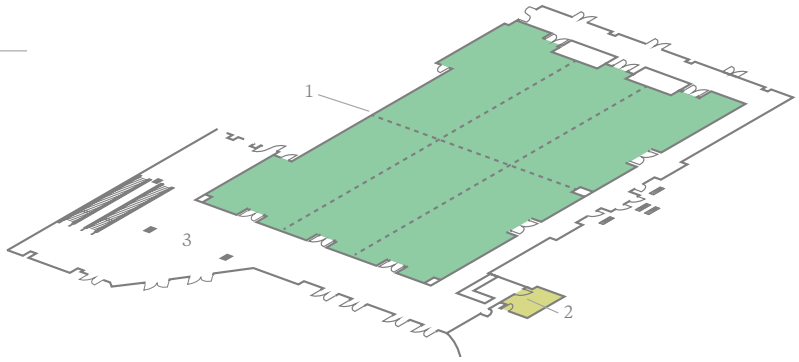
CONVENTION CENTER, MEZZANINE LEVEL

1. LAS OLAS BALLROOM
2. LAS OLAS PREFUNCTION
3. TANGENT
4. HIMMARSHEE



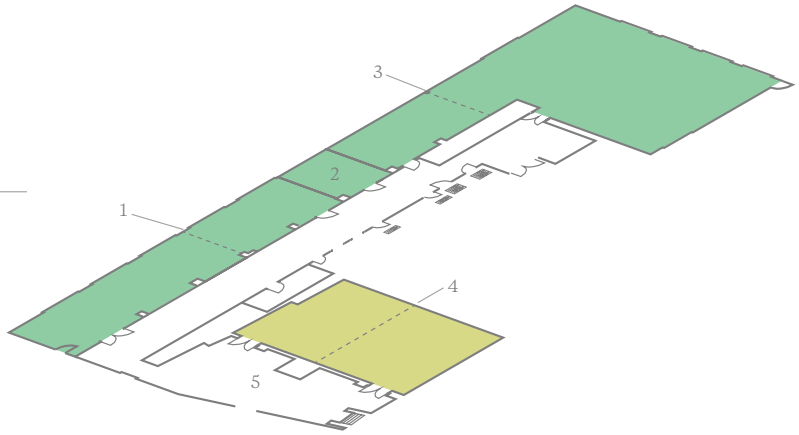
CONVENTION CENTER, FIRST FLOOR

1. ATLANTIC BALLROOM
2. SEAGRAPE
3. ATLANTIC PREFUNCTION

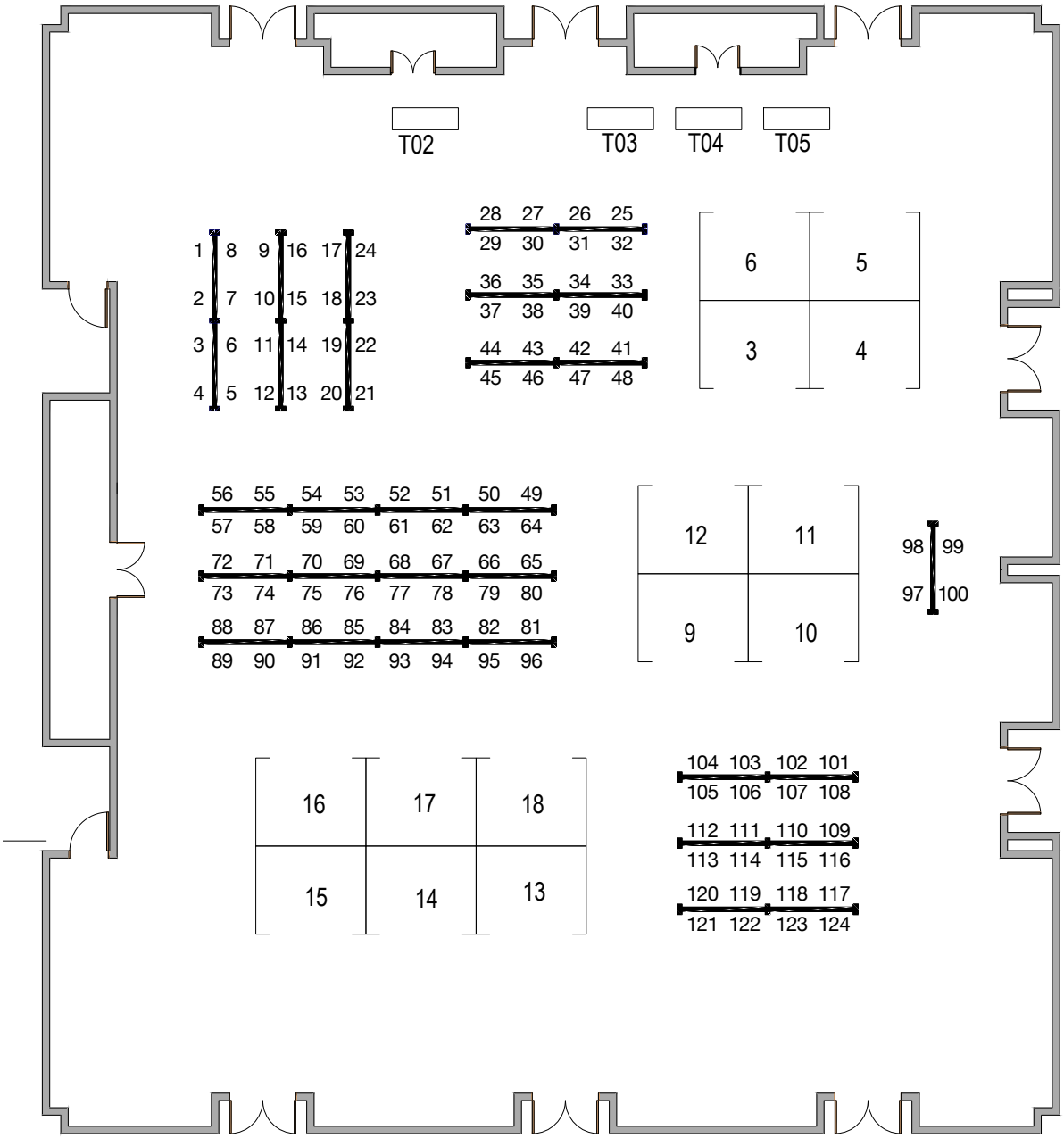


SOUTH TOWER, MEZZANINE LEVEL

1. BONNET
2. SEABREEZE
3. OCEANSIDE
4. RIO VISTA
5. RIO VISTA FOYER



POSTER AND EXHIBITOR FLOOR PLAN



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3	Delsys
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