Program

2019 ISPGR WORLD CONGRESS

June 30 to July 4
Edinburgh
Edinburgh International Conference Centre

@ISPGR
#ISPGR2019
ispgr.org
TABLE OF CONTENTS

Program at a glance ........................................ 2
Welcome letter ............................................. 3
Leadership ................................................... 4
Membership .................................................. 5
About ISPGR ................................................ 6
Congress general information ......................... 6
ISPGR half day tours ..................................... 8
Pre-congress workshops  
  Sunday, 30 June 2019 ................................. 9
Detailed program .......................................... 12
Pre-congress workshops ................................. 12
Awards ......................................................... 28
Keynote speakers ......................................... 30
Symposia abstracts ..................................... 34
Authors and presenters index ....................... 71
Poster session info ..................................... 81
  Poster session 1: Monday 1st July .............. 81
  Poster session 2: Tuesday 2nd July .......... 98
  Poster session 3: Thursday 4th July ....... 116
Exhibitor profiles ....................................... 134
Meeting floor plans ................................ 138
Poster & exhibitor floor plan .................... 139
Thank you to our supporters ..................... 140
We are honoured and excited to serve as co-chairs for the 2019 World Congress of the International Society of Posture and Gait Research. We are pleased to welcome you to the historic city of Edinburgh, the capital city of Scotland. This year marks the 50th anniversary of the marriage between basic and clinical researchers discussing and exchanging scientific knowledge surrounding postural control and gait. ISPGR has grown significantly from the first meeting in 1969. It all began as a relatively small discussion about posturography among researchers, mostly from Japan and Europe, and grew steadily to the current meeting of close to 700 delegates from around the world, discussing and sharing basic and clinical aspects of gait, posture, and balance control across the lifespan. We are extremely thrilled about the growth and success of this year’s meeting, we received a record number of abstract submissions. We are sure that the success of this meeting had nothing to do with us, but rather with the fact that Edinburgh is the second most popular tourist destination in the UK. Aside from its popularity, Edinburgh has long been a centre of education, particularly in the fields of medicine, the sciences, and engineering and so it is the perfect location to be celebrating our Society’s Golden anniversary. Neither of us are from this area, but as you know, the conference venues are chosen independent of the co-chairs’ affiliations in order to offer its members value for money, accessibility, great conference facilities, and tourist attractions. Our management company has worked hard to ensure excellent meeting, dining, and tourist experiences. In planning this meeting, we have built on the success of previous meetings and responded to member feedback by providing more of what you valued most. Accordingly, we have selected pre-conference workshops that reflect the needs of the members, brought in five excellent world-class keynote speakers to cover all the major areas of our society, and increased the number of member-led symposia sessions. As in previous years, we have allocated significant time and attention to poster presentations and scheduled them in such a way as to encourage attendance. We have also continued the Society’s tradition of focusing on young researchers and student members by awarding student oral, poster and travel awards, as well as recognizing excellent early-career researchers through the Emerging and Promising Scientist Awards. The impact of the Society’s dedication to student participation is highlighted by the fact that over 40% of our meeting attendance is made up of student members this year! We want to extend sincere thanks to all individuals who have dedicated their time to help organize this meeting. We extend special thanks to the members of the Scientific Content Committee, and particularly its Chair and ISPGR Vice-President, Dr. Vivian Weerdesteyn, who has worked hard to help us objectively select this year’s symposia, oral and poster presentations. We are also especially grateful to the members of the Awards Committee that have the challenging task of choosing winners for the awards. We also would like to thank the ISPGR board members for their continued support, and our Conference Organizers at Podium Conferences, who have been an essential partner to the Society. Finally, we thank you, in advance, for your individual contributions and efforts to help make this a memorable and successful meeting for all.

We encourage you to take advantage of the opportunity to share and discuss your work, but also to develop new networks of friends and colleagues, plan future collaborations, and create and exchange new ideas and perspectives.

Friends, colleagues, “Fàilte gu Dùn Èideann” and the 2019 World Congress of the ISPGR

Kristen Hollands & Michael Cinelli
Congress Chairs
LEADERSHIP

PRESIDENT
Mark Hollands  (Europe)
Liverpool John Moores University, GBR

VICE PRESIDENT
Vivian Weerdesteyn  (Europe)
Radboud University Medical Centre, NLD

SECRETARY
Kim Delbaere  (Asia-Pacific)
Neuroscience Research Australia, UNSW, AUS

TREASURER
Nicoleta Bugnariu  (Americas)
University of North Texas Health Science Center, USA

ELECTED REPRESENTATIVES: 2018 – 2022
Will Young  (Europe)
Brunel University, GBR
Herman van der Koij  (Europe)
Research Institute MOVE, NLD
John Stins  (Asia-Pacific)
University of Pittsburgh, USA
Patrick Sparto  (Americas)
University of Manitoba, CAN

SCIENTIFIC CONTENT COMMITTEE
Committee co-chairs:
Vivian Weerdesteyn  
Radboud University, NLD (ISPGR Vice-President)
Kristen Hollands  
University of Salford, GBR (2019 World Congress co-chair)
Michael Cinelli  
Wilfrid Laurier University, CAN (2019 World Congress co-chair)

Committee representatives:
Lisa Alcock  
Newcastle University, GBR
Fabio Augusto Barbieri  
Univ. Estadual Paulista, BRA
Tanvi Bhatt  
University of Illinois, USA
Michael Cinelli  
Wilfrid Laurier University, CAN
Mihalis Doumas  
Queen’s University Belfast, GBR
Brett Fling  
Colorado State University, USA
Richard Foster  
Research Institute for Spor and Exercise Sciences, GBR
Brook Galna  
Newcastle University, GBR
Kristen Hollands  
University of Salford, GBR
Mark Hollands  
Liverpool John Moores University, GBR
Klaus Jahn  
University of Munich, DEU
Claudine Lamoth  
University of Groningen, NLD
Avril Mansfield  
University of Toronto, CAN
Jasmine Menant  
Neuroscience Research Australia, AUS
Manuel Montero Odasso  
Western University, CAN
Martijn Muller  
University of Michigan, USA
Toshihisa Murayoshi  
Teikyo University, JPN
Melvyn Roerdink  
Vrije Universiteit Amsterdam, NLD
Kathryn Sibley  
University of Manitoba, CAN
Patrick Sparto  
University of Pittsburgh, USA
John Stins  
Research Institute MOVE, NLD
Herman van der Koij  
Delft University, NLD
Will Young  
Brunel University, GBR

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
- Opportunity to submit applications for student scholarships and awards
- 20% discount on a subscription to ISPGR’s official publication, Posture & Gait, published by Elsevier 8 times per year
- Ability to post and review job and grant opportunities
- Opportunity to post news and information on related events opportunity to vote in 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.

Students & Post Docs
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 good for a two-year period beginning on October 1 and expiring September 30 of the second year.

Regular member $150USD
Student/Post-Doc member $75USD

JOIN A COMMITTEE

All current ISPGR members are encouraged to serve on a Committee and actively engage in the future planning of the Society and World Congress. Committees include:
- Scientific content committee
- Awards committee
- External relations committee
- Communications committee
- Student/Post-Doc members

If you would like to learn more about committees or the Society, please join us on Monday July 1 at 17:45 at the Committees information meetings in the Sidlaw suite (level 3).
ABOUT ISPGR

The International Society of Posture and Gait Research (ISPGR), formerly known as the International Society of Posturography, is a staff-supported, member-driven organization with 300+ 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 in order 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 of 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 few 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 area of balance and gait control and at the annual meeting in 1986, the Society was renamed The International Society for Postural and Gait Research but was more familiarly known as the International Society for Posture and Gait Research. 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. A minor change to the Society name, plus revisions to the bylaws learning as related to control of balance and gait. A minor

A major change to the Society name, plus revisions to the bylaws allowed for the broad discipline of posture and gait. 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 area of balance and gait control and at the annual meeting in 1986, the Society was renamed The International Society for Postural and Gait Research but was more familiarly known as the International Society for Posture and Gait Research. 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. A minor change to the Society name, plus revisions to the bylaws learning as related to control of balance and gait. A minor

MEETING VENUE

Edinburgh International Conference Centre (EICC)
The Exchange, 150 Morrison St, Edinburgh EH3 8EE

(WWW.ISPGR.ORG | @ISPGR | JUNE 30 – JULY 4)

WORLD CONGRESS REGISTRATION

Registration for the Congress includes admission to all sessions, access to all coffee breaks and lunches daily. In addition, registration includes the welcome reception, plus the opportunity to purchase discounted tickets to the whisky tasting and gala dinner. All tickets can be purchased from the registration desk.

NAME BADGES

Your name badge is your admission ticket to the conference sessions, coffee breaks, meals, and reception. 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 Strathblane Hall, will be open during the following dates and times:

Sunday, June 30 07:30 – 19:30
Monday, July 1 07:30 – 17:30
Tuesday, July 2 07:30 – 17:30
Wednesday, July 3 07:30 – 13:00
Thursday, July 4 07:30 – 17:30

SOCIAL MEDIA POLICY

The use of social media onsite at conferences is on the rise. This may create some opportunities but may also be considered by some as a threat. We propose to emphasize the opportunities; increased exposure, openness, and inclusiveness, while also providing the opportunity to help support those who wish to prevent unwanted exposure.
ISPGR encourages communication between members and the use of social media. Please note the following guidelines:

- ISPGR provides icons and stickers for permission and prohibition of photo recording, video recording and sharing on social media. These stickers are available onsite at the registration desk, and online as jpeg icons.

- ISPGF.org/presentation-guidelines to include with online presentations

- Members are encouraged to explicitly indicate their wishes by using the various stickers and icons available to them.

- Please respect a presenters’ wishes if they indicate the information presented is not to be captured or shared.

- If there’s no explicit indication of intent, assume that any media capturing of the presentation is prohibited and ask presenter their wishes. Always take into consideration the possibility that presenters do not want their presentation to be recorded or shared.

SPEAKER INFORMATION

For all oral sessions, each room will be equipped with
- 1 laptop (facilitating both Keynote and PowerPoint)
- 1 LCD projector
- 1 microphone
- 1 laser pointer

All speakers must refer to their specified upload times, sent previously via email and included on the app and website. Please visit the registration desk if you have any questions.

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, July 1 07:30 – 08:30
  - Dedicated time: Monday, July 1 10:30 – 12:30
  - Remove: Monday, July 1 by 18:00

- Poster session 2
  - Set-up: Tuesday, July 2 07:30 – 08:30
  - Dedicated time: Tuesday, July 2 10:30 – 12:30
  - Remove: Tuesday, July 2 by 18:00

- Poster session 3
  - Set-up: Thursday, July 4 07:30 – 08:30
  - Dedicated time: Thursday, July 4 10:30 – 12:30
  - Remove: Thursday, July 4 by 15:45

Any posters not removed by the identified time will be held at the registration desk until the end of the congress. Any posters that remain unclaimed by the end of the congress will be disposed of.

Information on poster authors, poster numbers and poster titles begin on page 71. For a complete copy of all the poster abstracts, please visit ispgf.org, where you can download an electronic copy.

Easy reference poster floor plans can be found on page 138.

STAFF

ISPGR staff from Podium Conference Specialists can be identified by the orange ribbons on their name badges. Feel free to ask any one of our staff for assistance.

INTERNET SERVICES

ISPGR attendees have access to complimentary WIFI in the meeting area space area.

WIFI instructions:

Username: Delegate
Password: haymarket
ISPGR HALF DAY TOURS

WEDNESDAY, JULY 3

TOUR 1: HISTORIC WALKING TOUR INCLUDING ACCESS TO EDINBURGH CASTLE

Skip the long queues for Edinburgh Castle, by joining this popular historic walking tour!

$45 USD per person (children 5-15 $30); includes a walking tour with local guide and front of queue access to Edinburgh’s Old Town.

Tour: The tours are leaving at various times starting from 13:00. If you have booked a tour, please check your departure time.

TOUR 2: GHOSTLY UNDERGROUND WALKING TOUR

$20 USD per person (children 5-15 $15); includes exclusive access to Edinburgh’s rarely seen underground vaults, and a lively walking tour with a local guide.

This walking includes exclusive access to some of Edinburgh’s most haunted underground vaults. First, you’ll follow your cloaked guide through the shadowy closes of Edinburgh’s Old Town. These are dark streets untouched by daylight, filled with a strange silence, their damp walls carrying only the faintest echo of the crowds on the high street you’ve left behind.

With the scene set, you’ll descend into the depths of Edinburgh’s Old Town. These are dark streets untouched by daylight, filled with a strange silence, their damp walls carrying only the faintest echo of the crowds on the high street you’ve left behind.

GHOSTLY UNDERGROUND WALKING TOUR

$20 USD per person (children 5-15 $15); includes exclusive access to Edinburgh’s rarely seen underground vaults, and a lively walking tour with a local guide.

All pre-congress workshops will take place at the Edinburgh International Conference Centre (EICC) unless otherwise stated.

JOURNAL WORKSHOPS

AUTHORS’ WORKSHOP:

Authors’ rights and responsibilities

Morning session: 08:30 – 10:00
Location: Carrick suite (level 1)
Organisers: Presented by the Editors and Publisher of Gait and Posture

WORKSHOPS

Mixed reality for posture and gait research: Principles and applications

Morning session: 09:30 – 11:30 (lunch on own)
Location: Tinto room (level 0)
Organisers: Melvyn Roerdink, Vrije Universiteit Amsterdam, NLD

Mixed reality, the integration of real and digital worlds, is the rising star in the virtuality continuum. A promising advance in that regard are untethered and transparent headsets equipped with a holographic display unit, through which 3D holograms are not only overlaid but anchored to and interacting with the wearer’s environment. This merging of real and digital worlds affords a realistic interaction with digital content during free movements in open environments. The main goal of this mixed-reality workshop is to get attendees familiar with the basic principles of mixed reality and its potential for posture and gait research through lecture-like plenary presentations intermingled with demos. What is mixed reality? How does it relate to virtual reality and augmented reality? How does it merge holographic content with the real world? What can I do with mixed reality? A second goal is to offer attendees hands-on experience with mixed reality in a research context through four different interactive demos: 1) the eyes, the ears and the brains of mixed reality, 2) Holobstacle, a mixed-reality application for studying holographic obstacle avoidance in the lab, 3) MA-Automated Mobility Assessment, a mixed-reality application to guide the wearer to self-initiate and complete clinical mobility assessments and 4) Holocue, a mixed-reality application for on-demand cue activation to reduce freezing of gait in Parkinson’s disease patients.

Pursuing an industry position after graduate school

Morning session: 08:30 – 11:30 (lunch on own)
Location: Moorfoot room (level 0)
Organisers: Adam Goodworth, University of Hartford, USA

Graduates with advanced degrees in human movement disciplines are often interested in non-academic career pathways. However, graduates are typically provided with very little perspective or direction in how to consider a non-academic career path. This workshop will cover many aspects of how to pursue and succeed in a non-academic career and will include lecture-like plenary presentations and hands-on workshops. What are the different non-academic career pathways? What are the skill sets required to succeed in these fields? How can you prepare for these positions? How do you find out about these career pathways? How can you get your foot in the door and succeed in a non-academic career?
career. As it turns out, there are a wide variety of non-academic pathways. These include start up companies, clinical facilities, product development, forensic sciences, private research centers, and more. Our workshop will provide 1) an overview of the common non-academic career pathways, 2) presentations from ISPGR members with significant non-academic employment, 3) a question and answer session with the speakers and a panel of approximately five ISPGR industry sponsors, and 4) an open time for relationship building. To focus on a pragmatic goal, presenters and panel members will address three guiding questions – 1) How is/was research conducted and applied in your non-academic setting, 2) What skills do potential employees need to be successful in your setting, 3) What are practical steps interested researchers and graduate students could take to move toward a career in your setting? The presentation is geared toward graduate students and academic faculty interested in a non-academic career. However, established academic researchers may also find the workshop interesting to help in their mentoring of graduate students in career directions, and to gain knowledge about how research is translated and used in non-academic settings.

Speakers Include:

Lewis Nasher – Experience leading clinical rehab engineering companies
James Borrelli – Experience in forensic engineering
Tyler Cuddeford – Experience in Nike Sport Research Lab
Rebecca Robins – Data science management at DataCamp

WORKSHOP 3: Assessing real world mobility: Are we ready for the digital revolution?
Afternoon session: 12:30 – 15:30 (lunch on own)
Location: Moorfoot room (level 0)
Organiser: Lynn Rochester | Newcastle University, GBR
The goal of the workshop is to provide the audience with a comprehensive overview of the challenges and opportunities of digital technology to assess real world mobility outcomes. Given the ageing population and concomitant increasing chronic burden, we need low-cost, widely-accessible tools to measure, monitor, and predict mobility problems. Mobility assessment in the real world forms the ideal place and digital technology the ideal partner. But are we ready for this? What are the significant challenges associated with this endeavour? This pre-conference workshop will review the state of the art of current mobility assessment tools across a range of different and relevant disease populations to set the scene for where we are now. We will then explore the challenges and opportunities of digital technology to enhance the current status from a range of different perspectives: the technical challenges for accurate measurement; clinical validation; the big-data challenge; the end user of technology; and implementation in practice.

WORKSHOP 4: Advanced rehabilitation technology to boost your research!
Afternoon session: 12:30 – 15:30 (lunch on own)
Location: Offsite (University of Edinburgh venue)
For a detailed program and directions to the venue, please refer to the congress resources section of the congress app
Location link: www.ed.ac.uk/informatics/about/location
Organiser: Frans Steenbrink | Motek Medical
In this workshop we will outline the state-of-the-art of currently available rehabilitation technology for gait and balance research. More specifically, we will focus on real-time visual feedback, gait adaptability, and gait perturbations using an instrumented dual-belt treadmill, motion-capturing and other technology in combination with an application development framework to create custom research applications. Compared to most other (over-ground) motion labs, the treadmill set-up allows for more functional gait tasks to be evaluated in scientific protocols. Also controlled manipulations, such as slit-belt walking with deviating speeds for each belt, can be used to study motor-control in both healthy individuals and patient. Cognitive, visual and mechanical perturbations using the walking surface of the treadmill can be used to study pathology-specific responses. By controlling input settings for the perturbations and collecting parameters related to balance and locomotion, input-output responses can be evaluated to better understand the human system. In this workshop we will introduce the different concepts related to advance human movement research. Together, we will think of examples of how new research concepts can be integrated in laboratory setting using different types of technology. Also, we will interactively show and adjust several research applications using motion capture and virtual reality technologies and invite you to engage in our discussion on how we can use technology better understand the health and pathological human balance-and locomotion system.

Need help managing your Conference or Association?

INTEGRATED ONLINE TOOLS

CONFERENCE MANAGEMENT
Run a smooth process to delivery and your conference revenue, we are here to help you plan, prepare and deliver an over-turning conference.

ASSOCIATION MANAGEMENT
As a busy researcher and scientist, you’re already doing a thousand jobs in your job, but without having to worry about managing your society. Strategies and tools, we can help.

WEB DESIGN & PRINT
Let us help make you look great with a modern, interactive website for your Society or Conference.

Find out how we can help

office@podiumconferences.com
www.podiumconferences.com

WE SPECIALIZE IN

Scientific, Academic & Research Societies and their Conferences
DETAILED PROGRAM

SUNDAY JUNE 30

All congress sessions will take place at the Edinburgh International Conference Centre (EICC) unless otherwise stated.

PRE-CONGRESS WORKSHOPS

MORNING WORKSHOPS

08:30 - 10:00  Gait & Posture authors' workshop: Authors' rights and responsibilities
Location: Carrick (level 1)

08:30 - 11:30  WS.1. Mixed reality for posture and gait research: Principles and applications
Location: Moorefoot (level 0)

08:30 - 11:30  WS.2. Pursuing an industry position after graduate school
Location: Tinto (level 0)

10:15 - 11:45  Gait & Posture reviewers' workshop: Identifying limitations in scientific articles
Location: Carrick (level 1)

AFTERNOON WORKSHOPS

12:30 - 15:30  WS.3. Assessing real world mobility: Are we ready for the digital revolution?
Location: Moorefoot (level 0)

12:30 - 15:30  WS.4. Advanced rehabilitation technology to boost your research!
Location: Offsite (University of Edinburgh venue)

Please refer to the ‘congress resources’ section of the app for further details on venue and program. Location info: www.ed.ac.uk/informatics/about/location

OPENING OF WORLD CONGRESS 2019

16:30 – 17:00  Opening ceremony
Location: Pentland auditorium (level 3)

17:00 – 18:00  Keynote lecture 1
Location: Pentland auditorium (level 3)
Janice Eng  University of British Columbia, CAN
Interventions to improve mobility after stroke: A journey from mechanisms and clinical trials to implementation science
Chair: Michael Cinelli  Wilfrid Laurier University, CAN

18:00 – 19:30  Opening reception
Strathblane Hall (level 0)

MONDAY JULY 1

LECTURES

08:30 – 09:30  Keynote lecture 2
Location: Pentland auditorium (level 3)
Herman van der Kooij  University of Twente, NLD
Studying human balance control by perturbations: Insights and applications for wearable robotics
Chair: Vivian Weerdesteyn  Radboud University Medical Center, NLD

09:30 – 10:00  Honorary member presentation
Location: Pentland auditorium (level 3)
2019 Honorary members:
Anne Shumway-Cook  University of Washington, USA
Rolf Moe-Nilssen  University of Bergen, NOR

10:00 – 12:30  Posters session 1 and exhibitors
(Refreshments provided 10:00 – 10:30)
Location: Strathblane & Lomond (level 0)
Poster listings begin on page 71

12:30 – 13:30  Lunch and exhibits
Location: Strathblane & Lomond (level 0)
**SYMPOSIUM SESSIONS 1 – 3**

**S.1 Virtual reality in motion: Moving posture and gait research forward with do-it-yourself vs turnkey systems**
Location: Pentland suite (level 3)
Chair: Anouk Lamontagne  
McGill University, CAN
Moderators: Haylie Miller  
UNT Health Science Centre, USA
Meir Plotnik  
Sheba Medical Center, ISR
Participants:
Desiderio Cano Porras  
Tel Aviv University and Center of Advanced Technologies in Rehabilitation, ISR
Marco Buhler  
McGill University, CAN
Nicoleta Bugnariu  
University of North Texas Health Science Center at Forth Worth, USA
Anouk Lamontagne  
McGill University, CAN
Meir Plotnik  
Sheba Medical Center, ISR

**S.2 fNIRS data to understand cortical mechanisms underpinning exercise interventions**
Location: Fintry suite (level 3)
Chair: Jasmine Menant  
NeuRA, Australia, AUS
Participants:
Pablo Pelicioni  
Neuroscience Research Australia, AUS
Eling de Bruin  
ETH Zurich, CHE
Rodrigo Vitorio  
Instituto de Biociências, UNESP – Universidade Estadual Paulista, BRA
Anat Mirelman  
Tel-Aviv Sourasky Medical Centre, ISR

**S.3 Balance, gait and falls post stroke: Steps towards a better future**
Location: Sidlaw suite (level 3)
Chairs: Vivian Weerdesteyn  
Radboud University Medical Center, NLD
Itshak Melzer  
Ben-Gurion University of the Negev, ISR
Participants:
Shirley Handelzalts  
Ben-Gurion University of the Negev, ISR
Tanvi Bhatt  
University of Illinois, USA
Gelsy Torres-Oviedo  
University of Pittsburgh, USA
Jolanda Roelofs  
Radboud University Medical Center, NLD
Itshak Melzer  
Ben-Gurion University of the Negev, ISR
Vivian Weerdesteyn  
Radboud University Medical Center, NLD

**SYMPOSIUM SESSIONS 4-6**

**S.4 Going from here to there and beyond: Fundamental theories and applications from what we have learned about human navigation of cluttered environments**
Location: Fintry suite (level 3)
Chair: Anouk Lamontagne  
McGill University, CAN
Participants:
Bradford McFadyen  
Université Laval, CAN
Michael Cinelli  
Wilfrid Laurier University, CAN
Anne-Hélène Olivier  
Université de Rennes, Inria, FRA
Julien Pettré  
Université de Rennes, Inria, FRA

**S.5 Falls prevention should start in middle age - Lessons on prevention from cardiology may advance fall prevention in old age**
Location: Sidlaw suite (level 3)
Chair: Stephen Lord  
Neuroscience Research Australia, AUS
Participants:
James Richardson  
University of Michigan, USA
Michele Callisaya  
University of Tasmania, AUS
Mirjam Pijnappels  
VU Amsterdam, NLD
Kim Delbaere  
Neuroscience Research Australia, UNSW, AUS

**S.6 Turning as measure of functional mobility: When biomechanics, neural control, and technology come together**
Location: Pentland suite (level 3)
Chairs: Martina Mancini  
Oregon Health & Science University, USA
Fay Horak  
Oregon Health & Science University, USA
Participants:
Marco Schieppati  
International University of Health, Exercise and Sports, LUX
Lorenzo Chiari  
University of Bologna, ITA
Inbal Maidan  
Tel-Aviv Sourasky Medical Centre, ISR
Martina Mancini  
Oregon Health & Science University, USA

**Committee interest meeting**
Location: Sidlaw suite (level 3)

**Refreshment break**
Location: Strathblane & Lomond (level 0)
**TUESDAY JULY 2**

**08:30 – 09:30**  
**Keynote lecture 3**  
Location: Pentland auditorium (level 3)  
*Lynn Rochester* University of Newcastle, GBR  
**Gait - A step in the right direction?**  
Chair: *Sue Lord* Auckland University of Technology, NZL

**09:30 – 10:00**  
**PSA talk**  
Location: Pentland auditorium (level 3)  
*Jenna Yentes* University of Nebraska at Omaha, USA  
**Nonlinear analysis: Translating the theoretical into clinical applications**

**10:00 – 12:30**  
**Posters session 2 and exhibitors**  
(Refreshments provided 10:00 – 10:30)  
Location: Strathblane & Lomond (level 0)  
Poster listings begin on page 71

**12:30 – 13:30**  
**Lunch and exhibits**  
Location: Strathblane & Lomond (level 0)

**13:30 – 15:15**  
**SYMPOSIUM SESSIONS 7 – 9**

**5.7 From basic science to clinical practice: Anxiety, attentional focus and the control of posture and gait**  
Location: Pentland suite (level 3)  
Chair: *William Young* Brunel University London, GBR  
Participants:  
*Toby Elmers* Brunel University, GBR  
*Elmar Kal* VU Amsterdam, NLD  
*Martin Zaback* VU Amsterdam, NLD  
*Lis Uiga* VU Amsterdam, NLD

**5.8 Data analytics in the wild: Translating emerging wearable inertial and camera methods to fall prevention intervention strategies**  
Location: Fintry suite (level 3)  
Chairs: *James Tung* University of Waterloo, CAN  
*Alan Godfrey* Northumbria University, GBR  
Participants:  
*Alan Godfrey* Northumbria University, GBR  
*Silvia Del Din* Newcastle University, GBR  
*Mina Nouredanesh* University of Waterloo, CAN  
*Stephen Robinovitch* Simon Fraser University, CAN  
*Kim van Schooten* Neuroscience Research Australia (NeuRA), AUS

**5.9 Spinal cord stimulation for gait dysfunction and postural instability in Parkinson’s disease**  
Location: Sidlaw suite (level 3)  
Chair: *Mandar Jog* Western University, CAN  
Moderator: *Olivia Samotus* Western University, CAN  
Participants:  
*Olivia Samotus* London Health Sciences Centre, GBR  
*Romulo Fuentes* Universidad de Chile, CHL  
*Kim van Schooten* Neuroscience Research Australia (NeuRA), AUS  
*Helen Bronte-Stewart* Stanford University, USA

**15:15 – 15:45**  
**Refreshment break**  
Location: Strathblane & Lomond (level 0)

**15:45 – 17:45**  
**ORAL SESSIONS 1 – 3**

**O.1 Parkinson’s disease**  
Location: Fintry suite (level 3)  
Co-Chairs:  
*Martijn Muller* University of Michigan, USA  
*Brook Galna* University of Newcastle, GBR

**O.1.i Episodic motor impairments of falls and freezing of gait differ in regional cerebral central cholinergic system changes in Parkinson’s disease**  
Presenter: *Nicolaas Bohnen*  
*Nicolaas Bohnen¹, Prabesh Kanel², Zhi Zhou², William Dauer², Roger Albin¹, Martijn Muller²*  
¹University of Michigan & VAMC, ²University of Michigan

**O.1.ii Immediate and long-term effects of intensive multimodal balance and gait training on gait and gait variability in Parkinson’s disease**  
Presenter: *Linda Rennie*  
*Linda Rennie¹, Niklas Löfgren¹, Erika Franzen²*  
¹Sunnaas Rehabilitation Hospital, ²Karolinska Institutet
O.1.iii Comprehensive measures of balance and gait in GBA mutation carriers and non-carriers in Parkinson's disease
Presenter: Rosie Morris
Rosie Morris¹, Douglas Martini¹, Katrijn Smulders², Valerie Kelly³, Amie Hiller¹, Kathy Chung¹, Shu-Ching Hu², Cyrus Zabelian³, Kathleen Poston¹, Ignacio Mata¹, Karen Edwards¹, Thomas Montine¹, Joseph Quinn¹, Fay Horak¹
¹Oregon Health & Science University, ²Sint Maartenskliniek, ³University of Washington, ⁴Stanford School of Medicine, ⁵University of California

O.1.iv Effects of a 6-week cognitively challenging agility exercise program in people with Parkinson's disease
Presenter: Fay Horak
Martina Mancini¹, Fay Horak¹, Naoya Hasegawa¹, Se Hee Jung¹, Vrutangkumar Shah¹, Anjanibhargavi Ragothaman¹, Daniel Peterson¹, Katrijn Smulders², Patricia Carlson-Kuha¹, John Nutt¹, Laurie King¹, Jodi Lapidus¹, Martina Mancini¹
¹Oregon Health & Science University, ²Sint Maartenskliniek

O.1.v Textured insoles improve gait in people with Parkinson's disease who have impaired peripheral sensation
Presenter: Graham Kerr
Graham Kerr¹, Feng Qiu¹, Keith Davids2, Ewld Hennig¹, Michael Cole¹, Sandy Brauer⁴, Anna Hatton⁴
¹Queensland University of Technology, ²Sheffield Hallam University, ³Australian Catholic University, ⁴University of Queensland

O.1.vi Test-retest reliability and minimal detectable change of the new freezing of gait questionnaire
Presenter: Pieter Ginis
Pieter Ginis¹, Carolien Strouwen², Bauke Dijkstra¹, Bastiaan Bloem³, Alice Nieuwboer¹
¹KU Leuven, ²Hasselt University, ³Radboud University Medical Center

O.1.vii Gait deficits in early stage Parkinson's disease are related to the expression of REM sleep without Atonia
Presenter: Colum Mackinnon
Sommer Amundsen Huffmaster¹, Matthew Petrucci¹, Devin O'Connell¹, Maria Lynn-Evans², Jae Woo Chung¹, Paul Tuite¹, Colum Mackinnon¹
¹University of Minnesota

O.1.viii Inter-individual balance adaptations in response to perturbation treadmill training in Parkinson's disease
Presenter: Sarah Klamroth
Sarah Klamroth¹, Heiko Gassner², Jürgen Winkler¹, Björn Eskofier¹, Jochen Klucken³, Klaus Pfeifer¹, Simon Steib²
¹Friedrich-Alexander-University Erlangen-Nürnberg

O.2 Aging and falls
Location: Pentland suite (level 3)
Co-chairs: Kathryn Sibley University of Manitoba, CAN
Fabio Barbieri São Paulo State University, BRA

O.2.i Prevention of cautious strategy in obstacle-avoidance situations in older adults: The effect of spatial constraints on collision-avoidance behavior
Presenter: Takahiro Higuchi
Takahiro Higuchi¹, Risa Okada¹, Ryo Watanabe¹, Takuya Goto¹, Tomoki Hakamata¹, Ryota Hiyoshi¹, Ryuma Yonemoto¹, Akiko Imura¹
¹Tokyo Metropolitan University

O.2.ii The association of clinic-based mobility tasks and measures of community performance and risk
Presenter: Michele Callisaya
Michele Callisaya¹, Joe Verghese²
¹University of Tasmania, ²Albert Einstein College of Medicine

O.2.iii The inter-relationships between glycemic markers and gait patterns across age groups
Presenter: Maayan Agmon
Maayan Agmon¹, Ram Weiss², Hagit Hochner³, Iaroslav Youssim³, Yechiel Friedlander³, Tamar Shochat¹, Rachel Kizony¹
¹University of Haifa, ²Hebrew University

O.2.iv Motoric cognitive risk syndrome and risk for falls, their recurrence and post-fall fractures: results from a prospective observational population-based cohort study
Presenter: Harmehr Sekhon
Harmehr Sekhon¹, Gilles Allali², Olivier Beauchet³
¹Jewish General Hospital and Lady Davis Institute for Medical Research, Faculty of Medicine, McGill University, ²Geneva University Hospital and University of Geneva

O.2.v Obstacle-induced trip perturbation training: proactive and reactive adaptation to reduce falls in community-dwelling older adults
Presenter: Yiru Wang
Yiru Wang¹, Shuaijie Wang¹, Tanjeev Kaur¹, Tanvi Bhatt¹
¹University of Illinois at Chicago

O.2.vi Standing steadiness and variability of older adults on a step ladder
Presenter: Erika Pliner
Erika Pliner¹, Daina Sturmiekis², Kurt Beschorn¹, Mark Redfern⁴, Stephen Lord⁴
¹University of Pittsburgh, ²Neuroscience Research Australia
O.2.vii The effectiveness of the StandingTall home-based, unsupervised balance exercise program in preventing falls in community-dwelling older people
Presenter: Kim Delbaere
Kim Delbaere¹, Kim van Schooten¹, Stephen Lord¹, Lindy Clemson², GA Rixt Zijlstra³, Jacqueline Close⁴
¹University of New South Wales, ²University of Sydney, ³University of Maastricht, ⁴Prince of Wales Hospital

O.2.viii Walking adaptability for targeted fall-risk assessments
Presenter: Daphne Geerse
Daphne Geerse¹, Melvyn Roerdink¹, Johan Marinus², Jacobus van Hilten²
¹Vrije Universiteit Amsterdam, ²Leiden University Medical Center

O.3 Somatosensory & vestibular function
Location: Sidlaw suite (level 3)
Co-chairs: Patrick Sparto University of Pittsburgh, USA
Mark Carpenter University of British Columbia, CAN

O.3.i Noisy galvanic stimulation and vestibular perception: Otolith versus semicircular canal mediated mechanisms
Presenter: Klaus Jahn
Klaus Jahn¹, Aram Keywan², Max Wuehr²
¹Schoen Klinik Bad Aibling and University of Munich, ²University of Munich

O.3.ii Postural regulation strategies in Ehlers-Danlos Syndrome hypermobility type
Presenter: Emma Gabrielle Dupuy
Emma Dupuy¹, Leslie Decker¹
¹UMR-S 1075 COMETE UNICAEN/INSERM

O.3.iii Haptic touch feedback that is sway-referenced and graded can improve center of mass stability in post-concussion syndrome
Presenter: Tyler Cuddeford
Andrew Meszaros¹, Alyssa Carey¹, Tyler Cuddeford¹
¹George Fox University

O.3.iv Perception of gait movements using gait-like vibrations in individuals with and without sensorimotor deficits
Presenter: Tapin Alexandre
Tapin Alexandre¹
¹Université de Montréal

O.3.v 3D head stability of people with vestibular dysfunction during gait in variable sensory conditions
Presenter: Brian Loyd
Brian Loyd¹, Janie Saviers-Steiger¹, Peter Fino¹, Serene Paul², Mark Lester³, Lee Dibble³
¹University of Utah, ²University of Utah, ³University of Sydney, ⁴Army-Baylor University

O.3.vi Interaction between lower limb cutaneous and muscle afferent pathways during standing
Presenter: Robyn Mildren
Robyn Mildren¹, Gregg Eschelmuller¹, Ryan Peters², Jean-Sebastien Blouin¹, Mark Carpenter¹, J. Timothy Inglis³
¹University of British Columbia, ²University of Calgary

O.3.vii Subthreshold electrical noise enhances mechanically-evoked cutaneous reflexes
Presenter: Tushar Sharma
Tushar Sharma¹, Ryan Peters², Leah Bent¹
¹University of Guelph, ²University of Calgary

O.3.viii The plantar surface of the foot: The bigger picture
Presenter: Leah Bent
Leah Bent¹, Erika Howe¹, Simone Smith¹, Nicholas Strzalkowski², Ryan Peters³, Timothy Inglis¹
¹University of Guelph, ²Mount Royal University, ³University of Calgary, ⁴University of British Columbia
10:30 – 12:30 **ORAL SESSIONS 4 – 6**

O.4 **Balance control**
Location: Fintry suite (level 3)
Co-chairs: Vivian Weerdesteyn, Radboud University, NLD
Daniel Peterson, Arizona State University, USA

O.4.i **Effect of external base-of-support perturbation parameters on measures of forward reactive stepping**
Presenter: Taylor Winberg
Taylor Winberg¹, Andrew Laing¹
¹University of Waterloo

O.4.ii **Upward perturbation – novel methodology to study stumbling during walking**
Presenter: Desiderio Cano Porras & Meir Plotnik
Desiderio Cano Porras¹, Jesse Jacobs², Rivka Inzelberg², Gabriel Zeilig¹, Meir Plotnik¹
¹Sheba Medical Center, ²University of Vermont

O.4.iii **A startle response is not evoked during falls following large postural perturbations in young adults**
Presenter: Andrew Sawers
Andrew Sawers¹, Stephen Robinovitch¹, Vivian Weerdesteyn²
¹University of Illinois at Chicago, ²Radboud University Medical Center

O.4.iv **Cortical midfrontal theta activity scales with acceleration of whole-body mechanical perturbations and reactive stepping behavior**
Presenter: Teodoro Solis-Escalante
Teodoro Solis-Escalante¹, Mitchel Stokkermans², Michael Cohen², Vivian Weerdesteyn¹
¹Radboud University Medical Center, ²Donders Institute for Brain, Cognition, and Behavior

O.4.v **Balance perturbation training for rehabilitation of dynamic balance in acquired brain injury victims: An exploratory interventional prospective trial and a neuroimaging investigation**
Presenter: Katherine Jouban
Katherine Jouban¹, Lior Shmuelof³, Simona Bar Haim³
¹Ben-Gurion University of the Negev

O.4.vi **Impaired sensorimotor transformations for balance in Parkinson disease are associated with future falls**
Presenter: J Lucas McKay
Lucas McKay¹, Kimberly Lang², Sistiana Bong³, Madeleine Hackney², Stewart Factor², Lena Ting¹
¹Emory University and Georgia Tech, ²Emory University

Presenter: Philipp Wanner
Philipp Wanner¹, Theresa Müller¹, Klaus Pfeifer¹, Simon Steib¹
¹Friedrich-Alexander University Erlangen-Nürnberg

O.4.viii **Neuromodulation of lumbosacral spinal networks enables independent standing after complete paraplegia**
Presenter: Dimitry Sayenko
Dimitry Sayenko¹, V. Reggie Edgerton², Yury Gerasimenko²
¹Houston Methodist Research Institute, ²University of California, Los Angeles

O.5 **Coordination of gait**
Location: Pentland suite (level 3)
Co-chairs: Nicoleta Bugnariu, University of North Texas Health Science Center, USA
Claudine Lamoth, University of Groningen, NLD

O.5.i **Muscle synergy complexity in children with cerebral palsy during the development of walking**
Presenter: Anniike Bekius
Anniike Bekius¹, Coen Zandvoort¹, Jennifer Kerkman¹, Andreas Daffertshofer¹, Annemieke Buizer¹, Jaap Harlaar², Nadia Dominici¹
¹Vrije Universiteit Amsterdam, ²Delft University of Technology

O.5.ii **Humans use multi-objective control to regulate lateral foot placement when walking**
Presenter: Jonathan Dingwell
Jonathan Dingwell¹, Joseph Cusumano¹
¹Pennsylvania State University

O.5.iii **Walking with narrow steps: Are we more stable through increased sensory contributions? A galvanic vestibular stimulation study**
Presenter: Sjoerd Bruijn
Sjoerd Bruijn¹, Jaap Van Dieën¹, Rina Magnani², Patrick Forbes³
¹VU Amsterdam, ²Göteborgs Stat University, ³Erasmus MC

O.5.iv **The spine in gait – a differentiated analysis of spinal rotational motion**
Presenter: Ulrich Betz
Ulrich Betz¹, Janine Huthwelker¹, Jürgen Konradi¹, Claudia Wolf², Ruben Westphal¹, Kjell Heitmann², Helmut Diers²¹
¹University Medical Center of the Johannes Gutenberg University Mainz, ²DIERS International GmbH

O.5.v **Spatial updating of remembered goal position during barrier avoidance**
Presenter: Brittany Baxter
Brittany Baxter¹, William Warren¹
¹Brown University
Type of prosthesis influences functional performance and quality of life in patients with transtibial amputations

Presenter: Ophélie Puissegur

Ophélie Puissegur¹, Gordon Stevens², Elizabeth Ginzel², Rita Patterson¹, Nicoleta Bugnariu¹

¹University of North Texas Health Science Center, ²Baker O&P

Deficient tibialis anterior activity following inward perturbation during walking predisposes elderly to use stepping rather than ankle strategies to control balance

Presenter: Maarten Afschrift

Maarten Afschrift¹, Friedl De Groote¹, Ilse Jonkers¹

¹KU Leuven

Influence of required coefficient of friction on rate of shoe wear

Presenter: Sarah Hemler

Sarah Hemler¹, Jessica Sider¹, Kurt Beschorner¹

¹University of Pittsburgh

Cognitive, attentional and emotional influences

Location: Sidlaw suite (level 3)

Co-chairs: Anat Mirelman - Tel Aviv Sourasky Medical Center, ISR
John Stins - VU Amsterdam, NLD

The effects of dual tasking and aging on event related potential (ERP) components of gait cycle

Presenter: Inbal Maiden

Inbal Maiden¹, Shiran Shustak¹, Dmitry Patashov², Eran Gazit¹, Boris Shapiro³, Aviran Levy², Nir Giladi³, Jeff Haussdorf⁴, Anat Mirelman¹

¹Tel-Aviv Sourasky Medical Center, ²Holon Institute of Technology

The neural signature of impaired dual tasking in Idiopathic REM sleep behavior disorder patients: An fMRI study

Presenter: Kaylena Ehgoetz Martens

Kaylena Ehgoetz Martens¹, Elie Matar², James Shine³, Joseph Phillips⁴, Matthew Georgiades¹, Ronald Grunstein⁵, Glenda Halliday⁶, Simon Lewis¹

¹University of Sydney, ²Brain and Mind Centre, ³University of Western Sydney, ⁴Woolcock Medical Institute

An invisible hand: Automatic preparation for arresting a fall when viewing a handrail

Presenter: David Cole

David Cole¹, Butler Blake², Mahmoud Mansour³, Sarah Schwartz⁴, David Bolton¹

¹Utah State University

Embodiment of painful situations and its postural correlates

Presenter: Thierry Lelard

Thierry Lelard¹, Olivier Godefroy², SaidAhmadi³, Pierre Krystkowiak⁴, Harold Mouras⁵

¹Université de Picardie

Shift in attentional allocation during cognitive-motor dual-tasking following cognitive or physical training in healthy older adults

Presenter: Rachel Downey

Karen Li¹, Rachel Downey¹, Louis Bherer², Thien Tuong Minh Vu³, Kristell Pothier⁴, Brittany Intzandt⁵, Tudor Vinceanu⁶, Thomas Vincent⁷, Anil Nigam⁸, Anthony Karelis⁹, Laurent Bosquet¹, Nicolas Berryman¹

¹Concordia University, ²Université de Montréal, ³Centre hospitalier Université de Montréal, ⁴University of Tours, ⁵Centre de recherche de l’Institut de Cardiologie de Montréal, ⁶Université du Québec à Montréal, ⁷Université de Poitiers, ⁸Bishop’s University

Postural threat effects on perceptions of lower leg somatosensory stimuli during standing

Presenter: Taylor Cleworth

Taylor Cleworth¹, Ryan Peters², Romeo Chua³, J. Timothy Inglis³, Mark Carpenter⁴

¹University of Waterloo, ²University of Calgary, ³University of British Columbia

Can split-belt treadmill training improve dual-task turning performance in patients with Parkinson’s disease with Freezing of gait

Presenter: Nicholas D’Cruz

Nicholas D’Cruz¹, Pieter Ginis¹, Jana Seuthe², Christian Schlenstedt¹, Alice Nieuwboer¹

¹KU Leuven, ²Christian-Albrechts-University (CAU) of Kiel

Look where you are thinking

Presenter: Yosef Koren

Yosef Koren¹, Yisrael Parmet¹, Ilai Sofer¹, Ohad Ben-Shahar¹, Rotem Mainer¹, Simona Bar-Haim¹

¹Ben-Gurion University

Free time and half day tours of Edinburgh

For details on the half day tours, please refer to page 8

THURSDAY JULY 4

Keynote lecture 5

Location: Pentland auditorium (level 3)

Trevor Drew - University of Montreal, CAN

A Cortical Network for the planning and execution of visually-guided gait modifications

Chair: Yury Ivanenko - IRCCS Fondazione Santa Lucia, ITA

Annual General Meeting

Location: Pentland auditorium (level 3)
10:00 – 12:30  **Poster session 3 and exhibits**
(Refreshment break from 10:00 – 10:30)
Location: Strathblane & Lomond (level 0)
Poster listings begin on page 71

12:30 – 13:30  **Lunch and exhibits**
Location: Strathblane & Lomond (level 0)

13:30 – 15:15  **SYMPOSIUM SESSIONS 10 – 12**

**S.10 Virtual reality as a tool to alter multisensory perception and human motor learning**
Location: Fintry suite (level 3)
Chair: Daniel Ferris  University of Florida, USA
Moderator: Karen Li  Concordia University, CAN
Participants:
Daniel Ferris  University of Florida, USA
Jennifer Campos  Toronto Rehabilitation Institute, CAN
James Finley  University of Southern California, USA
Karen Li  Concordia University, CAN

**S.11 Balance training using perturbations to prevent falls: Is it feasible and effective?**
Location: Pentland suite (level 3)
Chair: Stephen Lord  Neuroscience Research Australia, AUS
Participants:
Tanvi Bhatt  University of Illinois, USA
Kiros Karamanidis  London South Bank University, GBR
Avril Mansfield  Toronto Rehabilitation Institute, CAN
Yoshiro Okubo  Neuroscience Research Australia, AUS

**S.12 The challenge of preventing stair falls: Understanding the individual contributions of, and interplay between, environmental and intrinsic factors**
Location: Sidlaw suite (level 3)
Chair: Bradford J. McFadyen  Université Laval, CAN
Participants:
Richard Foster  Liverpool John Moores University, GBR
Alison Novak  Toronto Rehabilitation Institute-UHN, CAN
Neil Reeves  Manchester Metropolitan University, GBR
Mark Hollands  Liverpool John Moores University, GBR
Bradford McFadyen  Université Laval, CAN

15:15 – 15:45  **Refreshment break**
Location: Strathblane & Lomond (level 0)

15:45 – 17:30  **SYMPOSIA SESSIONS 13 – 15**

**S.13 Early development of human locomotion and its functional consequences**
Location: Fintry suite (level 3)
Chair: Yury Ivanenko  Fondazione Santa Lucia, ITA
Moderators: Marianne Barbu-Roth  Paris Descartes University, FRA
David Anderson  San Francisco State University, USA
Participants:
Marianne Barbu-Roth  Paris Descartes University, FRA
Yury Ivanenko  Fondazione Santa Lucia, ITA
David Anderson  Marian Wright Edelman Institute, San Francisco State University, USA
Christine Assaiante  Aix Marseille University, FRA

**S.14 Maximising interdisciplinary methods to assess falls risk in clinical groups**
Location: Sidlaw suite (level 3)
Chair: Chesney Craig  Manchester Metropolitan University, GBR
Moderator: Clemens Becker  Robert-Bosch Hospital, DEU
Participants:
Chesney Craig  Manchester Metropolitan University, GBR
Kim van Schooten  Neuroscience Research Australia, AUS
Will Young  Brunel University, GBR
Claudine Lamoth  University of Groningen, NLD
Clemens Becker  Robert Bosch Hospital, DEU
Yuhan Zhou  University of Groningen, NLD

**S.15 STOP! Age-related changes in sensorimotor inhibition and the associated implications for impaired gait and balance control**
Location: Pentland suite (level 3)
Chair: Brett Fling  Colorado State University, USA
Participants:
Brett Fling  Colorado State University, USA
Rachael Seidler  University of Florida, USA
Tibor Hortobagyi  University of Groningen Medical Center, NLD
Anita Christie  University of Western Ontario, CAN

17:30 – 18:00  **Awards presentation ceremony**
Location: Pentland (level 3)
– 2019 ISPGR World Congress ends –

19:00 – late  **Gala dinner**
Location: Cromdale Hall (EICC, level -2)
With entertainment provided by Òr Cèilidh Band
ToC

2019 ISPGR WORLD CONGRESS

ToC

2019 ISPGR WORLD CONGRESS

AWARDS

PROMISING SCIENTIST AWARD WINNER 2019
Sponsored by Elsevier, publishers of Gait & Posture Journal

The Promising Scientist Award acknowledges those who have performed superior research in posture and/or gait early in their career. The awards committee is pleased to announce this year’s award recipient

Jenna Yentes  University of Nebraska at Omaha, USA

Dr. Jenna Yentes received her PhD in biomechanics from the University of Nebraska in 2013. She is currently an Assistant Professor in the Department of Biomechanics at the University of Nebraska at Omaha, where she directs the INSPIRE research group. Her research focuses on functional outcomes in those that suffer from pulmonary disease, namely chronic obstructive pulmonary disease. Dr. Yentes’ group were the first to document biomechanical changes in gait in persons with chronic obstructive pulmonary disease. Jenna has also explored the clinical utility of locomotor respiratory coupling in this population. Her research has shown that non-varying coupling is related to energy expenditure. She has filed two patent applications related to a wearable technology for monitoring coupling. In addition, Dr. Yentes has published several methods papers regarding the use of nonlinear algorithms such as sample entropy in monitoring coupling. In this presentation, I will focus on nonlinear tools to quantify coupling of biorhythms (i.e., walking and breathing) and further, how these tools have been used to inform clinical applications.

PSA presentation: Tuesday July 2, 09:30 – 10:00

EMERGING SCIENTIST AWARD WINNER 2019
Sponsored by Elsevier, publishers of Gait & Posture Journal

The Emerging Scientist Award acknowledges those who have performed superior research in posture and/or gait within three years of their PhD degree. The awards committee is pleased to announce this year’s award recipient

Deborah Jehu  University of British Columbia, CAN

The objective of Deborah’s research has been to generate new insights into improving therapeutic intervention techniques, informing best practices in cognitive and mobility assessment, and increasing the knowledge on compensatory strategies across different sensorimotor, cognitive, and psychological contexts in populations with cognitive and mobility disability. Deborah completed her PhD in Human Kinetics at the University of Ottawa, and has collaborated with researchers, interdisciplinary healthcare professionals, health authorities, and industry partners in Winnipeg, British Columbia, Ontario, Hong Kong, and Portland. Now funded by the Michael Smith Foundation for Health Research and working with Dr. Liu-Ambrose, Deborah is expanding her expertise to include implementation science and the cognitive contributions following therapeutic interventions in clinical populations.

Best practices for the assessment and therapeutic intervention of cognition and mobility in aging populations

A fall can be life changing and even fatal. Exercise is the most important corrective factor in improving cognitive and mobility fall-risk factors. However, many interventions have been unsuccessful in decreasing fall-risk and/or falls, which may be a function of 1) the intervention itself or 2) the selected outcome measures. Design (i.e., frequency, intensity, type, and time) and delivery (e.g., intervention timing following injury) are important considerations for efficacious primary and secondary fall prevention interventions. Ensuring that the outcome measures have adequate psychometric properties is critical in order to determine that improvements are a result of the intervention rather than measurement error. Including commonly reported fall-risk outcome measures across interventions would also improve between-study comparability. Notably, both the intervention and assessment should be tailored according to the population. In this talk, I will discuss best practices in the assessment and therapeutic intervention of cognitive and mobility fall-risk factors across a variety of populations.

ESA presentation: Wednesday July 3, 09:30 – 10:00

CONFERENCE AWARDS
ISPGR is pleased to support the trainee members with presentation awards during the World Congress. Recipients of the various awards 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 awards will be announced at the closing session on Thursday July 4.

BEST TALK BY A TRAINEE
One best talk will be awarded to a student or post doc member of ISPGR who presents an oral presentation at the World Congress.

AFTAB PATLA INNOVATION AWARD
Thank you to NDI Digital for continuing to support the Aftab Patla 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.

TRAVEL STIPENDS
ISPGR is pleased to provide five trainee members with travel stipends based on their contributed submissions as selected by the Awards Committee. Congratulations to all the winners!

Annike Bekius  Vrije Universiteit, NLD
Muscle synergy complexity in children with cerebral palsy during the development of walking

Sarah Hemler  University of Pittsburgh, USA
Influence of required coefficient of friction on rate of shoe wear

Janis Kim  University of Illinois at Chicago, USA
The frequency and circumstances of falls reported by unilateral lower limb prosthesis users

Rosie Morris  Oregon Health and Science University, USA
Comprehensive measures of balance and gait in GBA mutation carriers and non-carriers in Parkinson’s Disease

Sutton Richmond  Colorado State University, USA
Bridging the callosal gap in gait: A mechanistic evaluation of white matter’s role in bilateral coordination

ISPGR is pleased to provide five travel stipends based on their contributed submissions as selected by the Awards Committee. Congratulations to all the winners!

ISPGR is pleased to provide five travel stipends based on their contributed submissions as selected by the Awards Committee. Congratulations to all the winners!

ISPGR is pleased to provide five travel stipends based on their contributed submissions as selected by the Awards Committee. Congratulations to all the winners!

ISPGR is pleased to provide five travel stipends based on their contributed submissions as selected by the Awards Committee. Congratulations to all the winners!

ISPGR is pleased to provide five travel stipends based on their contributed submissions as selected by the Awards Committee. Congratulations to all the winners!

ISPGR is pleased to provide five travel stipends based on their contributed submissions as selected by the Awards Committee. Congratulations to all the winners!

ISPGR is pleased to provide five travel stipends based on their contributed submissions as selected by the Awards Committee. Congratulations to all the winners!

ISPGR is pleased to provide five travel stipends based on their contributed submissions as selected by the Awards Committee. Congratulations to all the winners!

ISPGR is pleased to provide five travel stipends based on their contributed submissions as selected by the Awards Committee. Congratulations to all the winners!

ISPGR is pleased to provide five travel stipends based on their contributed submissions as selected by the Awards Committee. Congratulations to all the winners!

ISPGR is pleased to provide five travel stipends based on their contributed submissions as selected by the Awards Committee. Congratulations to all the winners!
**KEYNOTE SPEAKERS**

**Janice Eng**  
University of British Columbia, CAN

Janice Eng is a Professor in the Department of Physical Therapy at the University of British Columbia and Director of the Rehabilitation Research Program at the GF Strong Rehab Centre. She has clinical training in physical therapy and occupational therapy, as well as training in biomedical engineering. Her PhD was supervised by the late Dr. David Winter in the topic of 3D gait analysis. Since then, she has focused on stroke recovery and rehabilitation, from mechanisms to clinical trials, and more recently on implementation science. She is a Senior CANResearch Chair and has published over 200 peer-reviewed journal publications in the field of neurological rehabilitation. Two of her stroke exercise programs, GRASP and FAME for improving arm and hand function and FAME for improving fitness and mobility, are used in over 1500 sites in 40 countries. Through a series of randomized controlled trials, her FAME program has been shown to improve mobility, postural reflexes, fitness, bone health, cognition, and reduce falls in people living with a stroke.

**Keynote address:** June 30, 17:00 – 18:30

**Interventions to improve mobility after stroke: A journey from mechanisms and clinical trials to implementation science**

Stroke is a common condition with 1 in 5 persons having a stroke after age 55. Furthermore, there is an increasing stroke occurrence in younger adults due to the epidemic of obesity and diabetes. While stroke affects multiple domains of function, regaining and improving walking is high on the priority of stroke survivors. This presentation will first describe mechanistic research aimed at understanding how muscle function, balance and walking are altered by stroke. In addition, data quantifying the intensity of inpatient rehabilitation and physical activity in the community of individuals after stroke will be presented. The development and efficacy of interventions to improve postural reflexes, balance, mobility and reduce falls after stroke will then be discussed, including novel interventions utilizing wearable sensors, as well as robotic exoskeletons. In particular, the concept of repetitions and neuroplasticity, in addition to the importance of the time window of neurological recovery after stroke will be examined. Lastly, methods and theories to facilitate the implementation of complex stroke rehabilitation and exercise programs will illustrate translation of knowledge to real-world practice.

**Herman van der Kooij**  
University of Twente, NLD

Prof. Dr. ir. Herman van der Kooij, (1970) received his PhD with honors (cum laude) in 2000 and is professor in Biomechatronics and Rehabilitation Technology at the Department of Biomechanical Engineering at the University of Twente (0.8 fte), and Delft University of Technology (0.2 fte), the Netherlands. His expertise and interests are in the field of human motor control, adaptation, and learning, rehabilitation and wearable robots, diagnostic, and assistive robotics, virtual reality, rehabilitation medicine, and neuro computational modeling. He has published over 200 publications in the area of biomechatronics and human motor control. He was awarded the prestigious Dutch VIDI and VICI personnel grants in 2001 and 2015 respectively. He is associate editor of IEEE TRBME and IEEE Robotics and Automation Letters, member of IEEE EMBS technical committee of Birobotics, and was member of several scientific program committees in the field of rehabilitation robotics, bio robotics, and assistive devices. He is the founder and coordinator of the European F7P project Symbitron, the national program wearable robotics and the national 4TU program Soft Robotics. He is the general chair of the IEEE Birobotics conference in 2018 in the Netherlands.

**Keynote address:** July 1, 08:30 – 09:30

**Studying human balance control by perturbations: Insights and applications for wearable robots**

We study human balance control during standing and walking by analysing the responses evoked by mechanical perturbations. We developed simple template models and more realistic neuro-mechanical models to interpreted and predict how humans respond to various mechanical perturbations and how they maintain balance. We translate these predictive models into human inspired controllers of wearable robots. We demonstrated that with this translational approach we can enhance standing balance and the walking speed of subjects with an incomplete spinal cord injury wearing an exoskeleton.

**Lynn Rochester**  
Newcastle University, GBR

Lynn is Professor of Human Movement Science in the Institute of Neuroscience, Newcastle University. She is Director of the Clinical Ageing Research Unit, a translational clinical research platform focussed on experimental medicine including a significant number of Parkinson’s disease clinical trials. She set up and leads the Brain and Movement Research Group (BAM) (bam-med.co.uk), comprised of a multidisciplinary team of clinicians, clinical scientists and clinical engineers with a research focus on age related gait and mobility disorders. Her main research interests are in neurodegenerative disease (particularly Parkinson’s disease) focused on the motor and non-motor mechanisms of gait and falls, surrogate markers of disease and disease progression (in particular cognitive decline and falls risk), development and evaluation of novel interventions, and technological applications in healthcare using wearable sensors. She is Chair of the Parkinson’s UK Excellence Network Evidence Based Practice Committee and takes a key role in academic and professional leadership. She is an honorary consultant physiotherapist and set up and leads an academic physiotherapy service based in the Regional Movement Disorders Service at Newcastle upon Tyne Hospitals NHS Foundation Trust.

**Keynote address:** July 2, 08:30 – 09:30

**Gait - A step in the right direction?**

How do we keep people with neurodegenerative disease mobile and safe? This was the question we started with many years ago. It is a fundamental aim and the raison d’etre for myself and my research group as we directed a concerted, collaborative effort over the subsequent decade. Why is this important? People who develop age related neurodegenerative conditions such as Parkinson’s have to cope with significant mobility problems. Walking (or gait) features at the top of their list of concerns. This is understandable as it reduces independence and leads to an increased risk of falls. As if this is not enough, becoming less active adds to the overall burden of disease. To date managing gait problems remains a significant challenge – not helped by the fact that an understanding of the causes is still evolving. Efforts to mitigate mobility loss by targeting gait impairments are therefore key and we need to start as early as possible. Gait is complex and complex problems require complex solutions! Adopting a 360-degree perspective provides a platform to approach this, incorporating a multi-disciplinary approach to include multiple contributing systems (including cognition and vision) and key pathological, neural and genetic substrates. We had two key objectives: to describe gait impairments from prodromal to late disease in PD, and to determine what drives them. Leveraging large and longitudinal datasets in well described patient cohorts was fundamental in combination with strategic collaboration and multidisciplinary input to help probe these objectives. We aimed to link our findings to novel measurement tools using wearable technology, and intervention development and this was coupled with a focus on the needs of our key stakeholders. Key insights demonstrated that gait impairments appear early even in the prodromal stages and drive early falls risk. They evolve selectively underpinned by multiple substrates enhancing our understanding of the mechanisms of gait impairment. Our findings promote an earlier, more preventative approach than previously recognised. Cognitive function, particularly attention, plays a significant role and impacts on the visual control of gait. We showed this is driven by shared pathological substrates such as cholinergic disturbance and abnormal proteinopathy. These findings have informed therapeutic approaches utilising attention as a substrate to improve movement amongst others. Conversely, gait impairments also provide insights into cognitive function, demonstrating their symbiotic relationship. This has delivered other benefits such as tools to predict declining cognitive function along with insights for therapeutic development. Extending the remit of measurement, we showed that different features of gait appear sensitive to different dementia subtypes. Together our work suggests that discrete patterns or signatures of impairment may support enhanced diagnosis even in early/prodromal detection and a window of opportunity for neuroprotective therapy.
Collectively our work has contributed to the role of gait as a clinical biomarker for enhanced diagnosis, disease monitoring and risk prediction and provided the basis for therapeutic development. We have linked our findings to develop the tools to translate our work to the real-world using low cost wearable technology. Importantly this has addressed an unmet need for industry, clinicians and patients – the key stakeholders of our work. We set out with an ambitious aim. We have learnt a lot along the way, most important of all being none of this is feasible without the collaborators and team to deliver it!

Adolfo Bronstein
Imperial College London, GBR

Adolfo Bronstein is Professor of Clinical Neuro-otology at Imperial College London and a Consultant Neurologist at Charing Cross Hospital and at the National Hospital for Neurology and Neurosurgery, Queen Square, London. He heads the Neuro-otology Unit in the Division of Brain Sciences at Imperial College.

He has written over 250 papers on clinical and basic aspects of eye movements, balance and spatial orientation.

His book, “Dizziness: a Recommissioned View” at the 2008 BMA Medical Book prize Competition. Prof Bronstein is an enthusiastic teacher of neuro-otology and has supervised over 20 PhD students and a graduate student. He has been a member of research societies. In 2008 he obtained the Nylen-Hallpike Prize of the Royal Society of Medicine.

He is also a member of the scientific advisory board of the European Federation of Neurology and the European Federation of Neuro-Otology.

Bronstein is an enthusiastic teacher of neuro-otology and has supervised over 20 PhD students and a graduate student. He has been a member of research societies. In 2008 he obtained the Nylen-Hallpike Prize of the Royal Society of Medicine. He has also access the Gain control mechanism so that visual stimulation can reverse the sway response direction. VEPR can also be re-oriented according to the position of the eyes in the head and the head on the trunk. This indicates that ocular and cervical proprioceptors must also access the Gain control mechanism so that visual stimuli can recruit and silence different postural muscles appropriately. The overall gain of the visuo-postural system is also influenced by less easily defined idiodynamic factors, such as visual dependence and psychological traits; interestingly both these factors have been found to be associated with poor long term outcome in vestibular disorders. The experimental results and model presented illustrate that the visuo-postural system is a wonderful example of interaction between physics (e.g. stimuli geometry, body dynamics), neuroscience and the border zone between neurology and psycho-omatic medicine.

References:


Adolfo Bronstein
Imperial College London, GBR

Adolfo Bronstein is Professor of Clinical Neuro-otology at Imperial College London and a Consultant Neurologist at Charing Cross Hospital and at the National Hospital for Neurology and Neurosurgery, Queen Square, London. He heads the Neuro-otology Unit in the Division of Brain Sciences at Imperial College.

He has written over 250 papers on clinical and basic aspects of eye movements, balance and spatial orientation.

His book, “Dizziness: a Recommissioned View” at the 2008 BMA Medical Book prize Competition. Prof Bronstein is an enthusiastic teacher of neuro-otology and has supervised over 20 PhD students and a graduate student. He has been a member of research societies. In 2008 he obtained the Nylen-Hallpike Prize of the Royal Society of Medicine.

He is also a member of the scientific advisory board of the European Federation of Neurology and the European Federation of Neuro-Otology.

Bronstein is an enthusiastic teacher of neuro-otology and has supervised over 20 PhD students and a graduate student. He has been a member of research societies. In 2008 he obtained the Nylen-Hallpike Prize of the Royal Society of Medicine. He has also access the Gain control mechanism so that visual stimulation can reverse the sway response direction. VEPR can also be re-oriented according to the position of the eyes in the head and the head on the trunk. This indicates that ocular and cervical proprioceptors must also access the Gain control mechanism so that visual stimuli can recruit and silence different postural muscles appropriately. The overall gain of the visuo-postural system is also influenced by less easily defined idiodynamic factors, such as visual dependence and psychological traits; interestingly both these factors have been found to be associated with poor long term outcome in vestibular disorders. The experimental results and model presented illustrate that the visuo-postural system is a wonderful example of interaction between physics (e.g. stimuli geometry, body dynamics), neuroscience and the border zone between neurology and psycho-omatic medicine.

References:


Trevor Drew
University of Montreal, CAN

Trevor Drew undertook his undergraduate studies in physiology at Bristol University and then undertook a Ph.D at the same institution under the supervision of Dr. David Armstrong. He received his Ph.D in 1981. He then undertook postdoctoral studies with Dr. Serge Rossignol at the Université de Montréal in Quebec, Canada. He accepted a position as assistant professor in the Department of Physiology in 1984 and became full professor in 1996. He transferred his affiliation to the Department of Neuroscience on its formation in 2013. His research is directed at the contribution of supraspinal structures to the control of visually-guided locomotion and particularly how we plan visually-guided modifications of gait. Much of his work has focused on the contribution of the motor cortex to the execution of gait modification but recent work has concentrated on the contribution to planning. This latter work has focused on the contribution of the posterior parietal cortex and, more recently, the premotor cortex. Each of these areas (in contrast to the motor cortex) shows increased neuronal activity prior to gait modifications, consistent with contributions to different aspects of planning, including: object localisation; limb selection; foot placement; and limb trajectory formation.

Keynote address: July 4, 08:30 – 09:30

A Cortical network for the planning and execution of visually-guided gait modifications

Even in the most mundane of situations, we continually modify our gait to manoeuvre around natural and man-made obstacles, such as the curbs on each side of a street. In more exacting circumstances, for example, walking in the mountains or playing sports, such modifications of gait become more critical and more complex.

Common to all such gait modifications in healthy subjects is the use of vision to evaluate the terrain and to anticipate changes to the normal gait pattern. Such anticipatory gait modifications are produced by a rich network of cortical and subcortical structures. In my presentation, I will discuss the cortical contribution to such visually-guided gait modifications with a particular emphasis on the planning processes that are required to successfully negotiate a moving obstacle. These planning processes begin with the identification of the presence and the dimensions of an obstacle, together with the location of that obstacle with respect to the body. Subsequently, one must select the limb that will be the first to step over that obstacle and assure that the supporting (plant) limb is appropriately positioned in front of the obstacle.

Studies in cats, from multiple laboratories, have shown the importance of the motor cortex for the production of the pattern of muscle activity in the limb as it steps over an obstacle. However, the available evidence suggests that the motor cortex does not participate in the planning of that step. Instead, our studies point to the posterior parietal and premotor cortices (PPC and PMC) as being involved in the planning. Results from lesion and single unit recording studies in cat suggest that the PPC is important in estimating the relative location of an obstacle with respect to the body. However, there is little evidence that the PPC is directly involved in specifying the changes in muscle activity in a given limb during the approach to the obstacle.

Instead our recent studies suggest that heterogeneous populations of cells in the PMC contribute to this transformation of a global signal into one that specifies the precise spatiotemporal pattern of muscle activity required to step over a moving obstacle.

In sum, the available evidence suggests a cortical network for the planning and execution of gait modifications that resembles that described in detail for the control of reaching in non-human primates. However, while reaching studies are generally made from a static position, the planning of gait modifications requires dynamic processes that must integrate and account for the movement of both the subject, and if necessary, objects in the environment.

The studies summarized here, provide a starting point for understanding this complex behaviour. (Supported by the CIHR).
**S.1 Virtual reality in motion: Moving posture and gait research forward with do-it-yourself vs turnkey systems**

Chair: Anouk Lamontagne  
McGill University, CAN  
Location: Pentland suite (level 3)  
Moderators: Haylie Miller  
UNIV Health Science Centre, USA  
Meir Plotnik  
Sheba Medical Center, ISR

**Complex problems require complex solutions - Dynamic postural control in ecologically valid virtual environments**

Nicoleta Bugnariu¹, Haylie Miller², Rita Patterson², Linda Thibodeau³  
¹University of North Texas Health Science Center, ²University of Texas at Dallas

**BACKGROUND:** Clinical assessments of sensory, perceptual and cognitive elements that influence postural control are often conducted in a fragmented way, one at the time. Likewise, common clinical balance and mobility assessments often have low sensory and attentional demands. The disconnect between these discipline-specific findings obtained while patients are seated (e.g. hearing loss, cognitive impairment), and the impact of these findings in the real world where patients need to maintain balance and walk in complex environments, while attending to cognitive tasks and social interactions, represents a barrier in defining the true-effect of a particular impairment on postural control. **METHODS:** We used a high-fidelity immersive virtual reality system (CAREN, MotekforceLink) with motion capture, surround sound with integrated standardized audiological tests and eye-tracking, to investigate multisensory integration and postural control in adults and individuals with Autism Spectrum Disorder (ASD). In study 1, we tested dynamic postural control in 19 young (M=27.2), 20 old adults with normal hearing (M=68.7), and 20 old adults with hearing loss (M=71.2). Participants completed single- and dual- tasks of standardized audiological tests during surface perturbations in standing and walking. In study 2, we assessed dynamic balance of 6 age-matched pairs of seniors with and without ASD aged 18-43. Participants wore eye-tracking glasses (ETG 2.5w; SensoMotoric Instruments) that allowed binocular eye tracking at 60 Hz during natural, unrestricted head movement. **RESULTS:** Centre of pressure variability in mediolateral direction increased (p<0.05) in adults with hearing loss vs. controls when performing the dual postural/cognitive auditory task. Older adults with hearing loss had longer reaction time for initiating compensatory responses compared to healthy participants (p<0.01) both in single- and dual-task conditions. Self-selected gait speed was slower (p<0.05) in adults with hearing loss vs. controls, but only as long as they attended to the auditory task. In study 2, we observed a wider range of head-eye strategies used by participants to foatece targets compared to data generated using lower-end VR, and quantified differences in ASD vs. controls in the use of the head and torso segments during stepping and leaning behaviors. The integration of eye-tracking with the 180° surround VR revealed reduced fixation of static stimuli and less efficient tracking of moving stimuli that likely contribute to impairments in postural control in ASD individuals. **CONCLUSIONS:** When auditory or visual inputs are reduced or conflicting, perception of the environment is incomplete and the cognitive demands may be increased, potentially leading to maladaptive balance responses. High-end immersive VR systems are powerful tools for manipulating inputs in repeatable and scalable ways to parse the various sensory influences on static and dynamic postural control in different populations.

**VR for investigating perception and action during locomotion and for balance and gait rehabilitation**

Desiderio Cano Porras¹, Gabriel Zeilig², Rivka Inzelberg², Meir Plotnik²  
¹Sheba Medical Center, ²Tel Aviv University

How do humans incorporate perception of gravity while walking? To what extent virtual reality (VR) technology contributes to engage neurological patients in balance and gait rehabilitation treatments? This presentation addresses this type of questions. The advent of VR, especially when combined with advanced motion capture that allows automated biofeedback, offers the unprecedented ability to manipulate visual perception and physical body-based demands for balance and walking tasks. Mainly through this ability, VR has succeeded to open new horizons for fundamental and applied research. First, we will present original research that involves a paradigm in which participated walking on a treadmill are exposed to virtual inclinations (i.e. VR visual scenes simulating uphill and downhill walking). By testing conditions in which the inclination of the visual scene was either congruent or incongruent with the physical inclination of the treadmill, this paradigm allowed us to effectively interfere with perception-action coupling. Our findings contribute to unravel mechanisms of sensorimotor integration in the context of environmental transitions, and provide evidence for a visual perception of gravity during locomotion. Second, to assess the clinical impact of VR on the rehabilitation of balance and gait, we will discuss the results of a recent study reviewing the application of VR in clinical trials, and the conclusions from a recent report based on three years of experience using VR in routine clinical practice. Additional perspectives on the implementation and effects of different VR systems during rehabilitation of neurological patients will be presented. Although the systematic review identified studies with evidence that VR has advantages to promote motor learning and motivation, an overall poor methodological quality and a lack of theory-driven choices is a serious concern. Lastly, understanding the characteristics of VR is key for the design and planning of research (e.g. to dissociate the impact of visual cues vs. physical body-based cues) and for addressing specific motor, sensory and cognitive deficits during neurological rehabilitation. For example, to combine VR with other devices in order to, besides the visual input stimulation, integrate other sources of sensory cues (e.g. vestibular, haptic). In terms of VR-based rehabilitation, an evidence-based framework to incorporate theories of neuroplasticity and motor learning is needed. In particular, considering that VR facilitates the incorporation of motor learning principles through task-oriented repetitive training. One challenge is to develop an efficient transition of VR-based rehabilitation as a tool for routine clinical practice.
show that VR can reproduce similar adaptations as a function of obstacle condition and repeated practice. Furthermore, differences obtained with the two types of HMD suggest that the characteristics of VR equipment can modulate the user’s responses.

S.1iv

Low-cost virtual reality tools for gait assessment and rehabilitation

Anouk Lamontagne¹, Joyce Fung¹
McGill University

BACKGROUND: Virtual reality (VR) allows creating ecological scenarios for assessment and training of complex motor tasks. While there is emerging evidence on VR effectiveness for gait rehabilitation, the complexity, high cost and poor accessibility of VR systems can limit its use in clinical settings. Our team is exploring the use of low-cost VR solutions made possible with advances in the games industry and their applicability to locomotor rehabilitation. More specifically, we: (1) developed a VR assessment to quantify goal-directed navigation deficits in post-stroke unilateral spatial neglect (USN); (2) identified barriers and facilitators to the use of VR for USN evaluation in the clinical setting; (3) examined the impact of a low-cost omnidirectional treadmill on locomotor adaptations and (4) developed a VR intervention protocol involving low-cost VR equipment to promote community ambulation after stroke.

METHODS: Low-cost immersive VR technologies and open-source game engines were used. In study 1, stroke participants with and without USN were assessed while navigating towards virtual shopping items located in different locations. In study 2, barriers and facilitators were identified using focus groups involving clinicians. In study 3, body kinematics were contrasted between walking on an omnidirectional treadmill vs. overground in healthy young participants. In study 4, an integrated knowledge translation approach was used to develop a VR training toolkit for community ambulation rehabilitation after stroke.

RESULTS: In study 1, the VR assessment revealed greater heading errors and navigation time in participants with USN. In study 2, several barriers and facilitators to using VR for USN assessment were identified, including personal, institutional, client suitability and equipment factors. In study 3, different strategies for speed adaptation (cadence and/or step length) and trajectory reorientation (temporal coordination of head, thorax, pelvis) were observed during treadmill vs. overground walking. In study 4, scenarios targeting different dimensions of community ambulation (e.g. endurance, speed, postural transitions, traffic, cognitive load) were created to assess locomotor adaptations that were observed in participants with USN.

CONCLUSIONS: Low-cost VR tools show great potential for assessment and training of locomotor disorders. Notably, results show that VR can identify visual-perceptual deficits in post-stroke USN and their impact on goal-directed navigation. Addressing the identified barriers/facilitators could assist the adoption of VR assessment tools in clinical settings. Locomotor adaptations in VR, however, differ to some extent from those observed in the physical world. As the technology is rapidly evolving, future research should focus on not only the validation of VR tools but also on developing training paradigms exportable to different VR systems.

S.2 ii

FNIRS data to understand cortical mechanisms underpinning exercise interventions

Chair: Jasmine Menant Neura, AUS
Location: Finty suite (level 3)

Effects of step training in older people and people with Parkinson’s disease on haemodynamic changes in cognitive and motor cortical areas during stepping performance and gait adaptability

Paulo Pelicioni¹
Neuroscience Research Australia

BACKGROUND AND AIM: There is accumulating evidence from functional near-infrared spectroscopy (fNIRS)-based studies of increased Prefrontal Cortex (PFC) activation when older people walk and perform a complex secondary task versus simple walking. This increased reliance on cognitive-motor control resources to maintain balance under challenging situations is also apparent in people with Parkinson’s Disease (PD), who display inherent motor impairments and executive functioning deficits. Impaired stepping and reduced cognitive functioning are well-established fall risk factors in older people and more so in people with PD. In pilot studies, home-based volitional step training while playing computer games significantly improved balance, dual-task ability and cognitive functioning in older people; such training modality is likely to equally benefit people with PD providing sufficient training dose and adequate initial supervision are given. Yet, the neural mechanisms underpinning the effectiveness of this training type have not been studied. As part of two ongoing randomized-controlled trials (RCTs), we aim to investigate the effects of the following in-home computerised game playing training interventions on haemodynamic changes in cognitive and motor cortical areas using fNIRS during stepping and gait tasks: (i) seated cognitive-only training using a touch pad versus cognitive-motor step training using a step mat versus usual care in older adults (smart-step RCT); (ii) combined cognitive-motor step mat training and reactive step training versus usual care in people with PD (SAFE-PD RCT). METHODS: The smart-step involves 75 older adults and its active interventions for 6 months (120min per week). The SAFE-PD involves 44 people with PD. The active intervention involves a 3-month home-based cognitive-motor stepping training programme (40-80min per week), supplemented with two laboratory-based sessions of reactive step training. In both RCTs, participants are assessed at baseline prior to randomisation and then at three (SAFE-PD) or six months (smart-step). Haemodynamic changes are recorded with a 16-optode fNIRS system placed over the PFC and motor cortices while participants perform three cognitive-demanding stepping tasks on a computerised mat (both RCTs) and a gait adaptability test (SAFE-PD only). RESULTS: The trials are ongoing and full results will be presented at the ISPGR World Congress. CONCLUSIONS: We hypothesise that: (i) for the smart-step, the 6-month training programs will improve participants’ cognitive performance in the cognitive training group and both cognitive and physical capacity in the cognitive-motor training group, and that such improved capacities will be associated with increased activity in the PFC region and motor cortices as applicable, (ii) for the SAFE-PD trial, the 3-month intervention will improve cognitive and physical capacities and increase PFC and motor cortices activity during the stepping and gait tests.

S.2i

FNIRS data to understand the effects of rhythmic auditory cueing and acute aerobic exercise on cortical activation during walking

Rodrigo Vitório¹
São Paulo State University (UNESP)

BACKGROUND AND AIM: The ability to cognitively process the environment and formulate appropriate locomotor plans for navigation can be compromised with ageing and in neurodegenerative pathologies such as Parkinson’s disease (PD). Ageing- and PD-related walking impairments are associated with increased risk of falling and decreased independence. Therefore, effective interventions aimed to maintain safe mobility in older adults and people with PD are essential. Although recent studies confirmed the involvement of functional alterations of the brain cortex to walking impairments, less is known about the extent to which therapeutic interventions are able to modify cortical activation related to walking. Rhythmic auditory cueing and aerobic exercise are two of the most common interventions used for gait rehabilitation in older adults and people with PD. However, the underlying neural correlates are unclear. Functional near infrared spectroscopy (fNIRS) devices, which assess cortical activity through the haemodynamic response of the brain, can be used to fill this gap in the literature. This symposium presentation will cover studies using fNIRS to examine the effects of rhythmic auditory cueing and acute aerobic exercise on cortical activation during walking in the context of ageing and PD.

METHODS: Protocols combining fNIRS data and spatiotemporal parameters of gait were used in two different experiments. Experiment #1 tested the effects of rhythmic auditory cueing in older adults. Cues were delivered with a digital metronome at preferred stepping frequency and participants were instructed to step in time to the beats. Experiment #2 is designed
to test the effects of a single 40-minute session of aerobic exercise (65% to 70% of the maximum heart rate; performed in a stationary bicycle ergometer) in people with PD. RESULTS: I will summarize findings from these two experiments and discuss them with those available in the literature. In short, findings from experiment #1 suggest that gait benefits (i.e., reduced gait variability) obtained with rhythmic auditory cueing were achieved through increased activity in multiple cortical areas. Although still preliminary, findings from experiment #2 suggest that prefrontal cortical activity slightly decreases after aerobic exercise in people with PD. CONCLUSIONS: FNIRS provides an innovative approach to assess brain cortical activity related to the control of human locomotion in interventional studies. FNIRS data can help researchers and health professionals to better understand the neural mechanisms underpinning the effectiveness of therapeutic interventions.

S.2iii Assessing human locomotion through mobile brain imaging techniques: Opportunities, pitfalls and future directions
Eling D. De Bruin¹, Federico Gennaro¹, Patrick Egggenberger²
¹ETH Zürich, ²EMPA

BACKGROUND AND AIM: EEG and Functional near-infrared spectroscopy (FNIRS) have been involved in several studies related to human mobility. Both measurements hint towards promising opportunities, however, there are some pitfalls that need to be resolved before considering their routine clinical use in isolation or in combination. We discuss several pitfalls and propose research addressing them. Examples relate to validity, reliability and reproducibility of these methods in ecologically valid scenarios and in different populations. METHODS: Recent technological developments give rise to the expectation that EEG and movement artefacts related problems during human locomotion might be overcome. Several studies started using FNIRS for the assessment of functional brain activation during human bipedalism. FNIRS has the advantage being less prone to movement artefacts compared to EEG. Therefore, using FNIRS to study brain activity during locomotion has some limitations. Some of these disadvantages can be eluded with the help of a multimodal approach where FNIRS and EEG are used in combination. RESULTS: FNIRS measures concentration changes in both HbO2 and Hb simultaneously, which has shown useful to remove movement artefacts (Cui et al., 2010). Limitations of FNIRS technology include its limited penetration depth (1-2 cm) which only allows to assess changes in superficial cortical areas, as well as the limited spatial resolution of ~1 cm (Tong and Frederick, 2010). Additionally, strenuous physical tasks may affect FNIRS signals due to systemic vascular changes (Perrey, 2008). Currently no standardized FNIRS procedures and signal processing techniques exist to measure cortical activity during locomotion (Herold et al., 2017; Vitorio et al., 2017). To improve accuracy and to test the effects of lesion characteristics on balance and gait capacity, gait, and hemiparetic lower limb function in PwS.

S.3: Balance, gait and falls post stroke: Steps towards a better future
Chairs: Vivian Weerdesteyn Radboud University Medical Center, NLD
Ishak Melzer Ben-Gurion University of the Negev, ISR
Location: Sidlaw suite (level 3)

S.3i Analysis of brain lesion impact on balance and gait after stroke
Shirley Handelzalts¹, Ishak Melzer¹, Nachum Soroker
¹Ben-Gurion University

BACKGROUND: Falls are among the most common medical complications after stroke. About 70% of persons with stroke (PwS) fall during the first six months after discharge from hospital or rehabilitation setting and it remains a considerable health concern throughout their life span. In addition to physical consequences associated with fractures and related injuries, falls may have serious psychological and social consequences such as functional decline, poor quality of life, dependency, social isolation and depression. Reactive balance control is essential for fall prevention, however, only a few studies have explored the effects of lesion characteristics (location and extent) on balance control in PwS. AIM: To assess the impact of lesion characteristics on reactive and anticipatory balance capacity, gait, and hemiparetic lower limb function in PwS.

METHODS: Forty-six subacute PwS were exposed to forward, backward, right and left unannounced horizontal surface translations in 6 increasing intensities, while standing. Fall threshold (i.e., perturbation intensity that results in a fall into the harness system) was measured. In addition, the Berg Balance Scale (BBS), 6 Minute Walk Test (6MWT) and Lower Extremity Fugl-Meyer (LEFM) were measured. Lesion effects were analyzed separately for left- and right-hemisphere damaged (LHD, RHD) patients, using voxel-based lesion-symptom mapping (VLSM).

RESULTS: Voxel clusters where damage exerted a significant impact on balance, gait and lower-limb function were found in the corticospinal tract, in its passage in the corticospinal tract, in its passage in the corona radiata and in the posterior limb of the internal capsule. Additional significant impact was found to lesions affecting the putamen and the external capsule. Balance, gait, and hemiparetic lower limb function showed much overlap of the corresponding significant voxel clusters. Test scores of RHD and LHD patients were affected largely by damage to homologous regions with the LHD group showing a wider distribution of significant voxels. CONCLUSIONS: The study corroborates and extends previous findings by demonstrating that balance control, gait, and lower limb function are all affected mainly by damage to essentially the same brain structures, namely - the corticospinal tract and adjacent structures in the capsular-pyramidal region.

S.3ii Perturbation-based assessment and training for fall-risk reduction in people with chronic stroke: Effect of perturbation intensity and motor-impairment on behavioral outcomes
Tel Aviv Sourasky Medical Center

BACKGROUND AND AIM: It is now well accepted that gait and mobility are complex activities that are not solely automatic but rather rely on cognition resources, particularly in tasks that require more attention and faster processing speed, such as multitasking and gait adaptability. Traditionally, the role of cognition was assessed using dual-task paradigms (walking while performing a secondary cognitive task) which provided indications of the role of attention and executive function in the regulation of gait control. Functional near-infrared spectroscopy (FNIRS), an optical neuroimaging technique for investigating brain activation while participants move freely, enabled a direct investigation of cognitive resources during gait. This talk will focus on the contribution of prefrontal cortex to movement, its adaptation with task difficulty and changes in activation with age and neurodegeneration. METHODS: Data will be presented from several studies using FNIRS exploring mechanisms of motor-cognitive interactions in Parkinson’s disease and effects of intervention. RESULTS: Data from recent FNIRS studies will be discussed regarding the role of the frontal cortex in the control and automaticity of gait in Parkinson’s disease and whether targeted interventions could reduce reliance on cognitive resources during walking. CONCLUSIONS: Points for discussion will be raised on automaticity of movement, potential interventions to enhance mobility and the use of FNIRS as an applicable clinical tool for assessment.
The spectrum of motor impairments and deficits in reactive balance continue to persist on a longer-term in hemiparetic stroke survivors even after recovering ambulatory ability, predisposing them to environmental falls. Previous work has established the significance of perturbation-based fall-risk assessment and training in prediction and reducing fall-risk in healthy older adults. This talk will focus on translation of work from the healthy older adults to people with chronic hemiparetic stroke (PwHS). We examined feasibility of using stance support surface perturbations (trip and slip) to assess reactive stability control, compensatory stepping and fall-risk in PwHS and examined contributions from paretic and non-paretic limbs for recovery. Results indicate that a ~50% fall rate during slip-stance perturbation with paretic compensatory stepping under unconstrained conditions and with paretic limb when explicit instructions were provided. Recovery from slips was more challenging with >70% and lack of step initiation than trip perturbations which yielded > 75% compensatory stepping responses and very few falls. PwHS demonstrated impaired intensity-scaling of reactive stepping responses compared to healthy age-similar adults. We subsequently also examined fall-risk in PwHS under both paretic and non-paretic limbs to overground gait-slips. The fall rate and stability control during overground slips was similar to stance-perturbations under both limbs when the perturbation intensity was small, however upon a longer slip, the fall under the paretic limb significantly increased, especially in those with greater lower limb motor impairment and gait abnormalities. We subsequently examined adaptation effects to a mixed slip-and-trip stance-perturbation training paradigm and effect of motor impairment on training-induced adaptations. Results indicated the ability of the high functioning, low impairment (HFLI) group to successfully tolerate large magnitude perturbations to rapidly improve stability control and lower fall incidence within 1st five trials. However the low functioning, high impairment group was able to demonstrate adaptation only after lowering perturbation intensity. Post-training both groups were able to demonstrate scaling to a higher intensity and shorter-term retention up to several weeks. Lastly, we examined the ability of training-induced adaptations to generalize to novel opposing trip perturbations and effect of mixed-slip-and-trip training on fall-risk and stability control. Findings indicate a positive transfer of training effects within the compensatory stepping response achieved by a direction specific amplitude modulation of step length and further ability of PwHS to adapt to mixed perturbation training by achieving a stability state that would be resilient to both slips and trips. These findings could be leveraged for designing protocols to enhance inter-limb generalization of training effects.

S.3iv

Minor stroke, major balance problems?
Jolanda Roelofs¹, Ingrid Schurt², Alfred Schouten², Alexander Geurts¹, Vivian Weerdesteyn¹
¹Radboud University Medical Center, ²Delft University of Technology

BACKGROUND AND AIM: Due to successful thrombolysis, an increasing part of the post-stroke population consists of individuals who have sustained a ‘minor stroke’. Thus far, this group has received very little attention, both clinically and scientifically, with regard to the possible motor consequences. Their usual care mainly focuses on prevention of a new stroke. Yet, persons after a minor stroke may still experience subtle balance and gait impairments, which are not always visible to the naked clinical eye. So far, the prevalence of these subtle impairments and their implications for daily life functioning are not clear. METHODS: This talk will summarize the evidence regarding the consequences of a minor stroke on physical capacity and functioning, with a particular emphasis on the results of two cohort studies we have recently conducted. Both studies included a (sub)group of people > 6 months after minor stroke with (almost) complete recovery of leg motor impairments (Fugl-Meyer assessment of the lower extremity >= 24). We will discuss the results of clinical and lab-based balance and gait tests, as well as data on falls and physical activity in daily life. RESULTS: Persons after minor stroke walked on average 0.5 km/h slower and scored 1.9 points lower on the mini-Balance Evaluation Systems Test (mini-BESTest; range: 0-28) compared to healthy age-matched controls. Thirteen percent of the persons after minor stroke scored near-maximal on the mini-BESTest, whereas this was the case for 61% of the controls. These impairments in dynamic balance capacity were also reflected by the lower perturbation intensities that persons after minor stroke could sustain with a single step and by the impaired reactive step quality after translational perturbations on a moving platform. During stepping from stance towards illuminated targets that sometimes moved during mid-step, minor stroke survivors placed their foot further from the new target position (i.e., made larger errors) than controls. Furthermore, 21% of the persons after minor stroke showed an asymmetric kinetic contribution of each leg to standing balance. With regard to daily life, persons after minor stroke fell twice as often as controls. In addition, the total intensity of daily physical activity (i.e., standing, walking, running, cycling) was lower for minor stroke participants compared to controls, whereas no significant differences were found in total time or volume (i.e., time x intensity) of physical activity. CONCLUSIONS: Individuals after minor stroke who present with (almost) complete clinical recovery of leg motor impairments may still show substantial balance and gait impairments. Given the double fall rates in this population, these balance and gait impairments appear to be clinically relevant. These results may point at an important unmet clinical need in the minor stroke population.

S.4i

Meeting the brief history of human biped navigation research head on
Bradford McFadyn¹
¹CIRBIS-Université Laval

This talk will summarize the evidence regarding the consequences of a minor stroke on physical capacity and functioning, with a particular emphasis on the results of two cohort studies we have recently conducted. Both studies included a (sub)group of people > 6 months after minor stroke with (almost) complete recovery of leg motor impairments (Fugl-Meyer assessment of the lower extremity >= 24). We will discuss the results of clinical and lab-based balance and gait tests, as well as data on falls and physical activity in daily life. RESULTS: Persons after minor stroke walked on average 0.5 km/h slower and scored 1.9 points lower on the mini-Balance Evaluation Systems Test (mini-BESTest; range: 0-28) compared to healthy age-matched controls. Thirteen percent of the persons after minor stroke scored near-maximal on the mini-BESTest, whereas this was the case for 61% of the controls. These impairments in dynamic balance capacity were also reflected by the lower perturbation intensities that persons after minor stroke could sustain with a single step and by the impaired reactive step quality after translational perturbations on a moving platform. During stepping from stance towards illuminated targets that sometimes moved during mid-step, minor stroke survivors placed their foot further from the new target position (i.e., made larger errors) than controls. Furthermore, 21% of the persons after minor stroke showed an asymmetric kinetic contribution of each leg to standing balance. With regard to daily life, persons after minor stroke fell twice as often as controls. In addition, the total intensity of daily physical activity (i.e., standing, walking, running, cycling) was lower for minor stroke participants compared to controls, whereas no significant differences were found in total time or volume (i.e., time x intensity) of physical activity. CONCLUSIONS: Individuals after minor stroke who present with (almost) complete clinical recovery of leg motor impairments may still show substantial balance and gait impairments. Given the double fall rates in this population, these balance and gait impairments appear to be clinically relevant. These results may point at an important unmet clinical need in the minor stroke population.
Human biped navigation, like all human movement, reveals a fusion between the person and the environment. We can only safely navigate when we properly attend to and anticipate the combined underlying personal and environmental aspects. Yet, effective and safe navigation is threatened by impaired personal capacity and precarious elements within the natural and built environment. While human biped navigation has evolved over millions of years, formal scientific study of it has only significantly progressed over the past few decades. This research has provided evidence of visual-locomotor coordination underlying anticipatory locomotor adjustments relative to environmental topography and social context.

Different theories regarding the roles of anticipatory versus on-line control of bipedal navigation have been proposed along with control variables such as personal space and time to contact that drive our locomotor adaptations. In this talk, I will lay out some of the current evidence from our and other laboratories with respect to theories and the control variables for human bipedal navigation, as well as briefly discuss the evolution in protocols that have been used including both real and computer-generated environments. In addition, I will discuss some of the advantages and disadvantages of transferring current evidence and protocols to the clinic to relate assessing and intervening in navigational capacity following acquired brain injury.

S.4i

Control laws that govern people's actions when interacting with other people and other objects in different environments

Michael Cinelli¹

Wilfrid Laurier University

Walking safely through a cluttered environment requires avoiding static and moving obstacles and, more specifically, other pedestrians. For example, collisions between pedestrians or other objects rarely occur because vision plays a key role in safety and efficiently guiding routes away from collisions and towards open spaces. Visual information about an environment is gathered through eye movements, which allows individuals to appropriately adapt locomotion in response to obstacles. In this way, vision helps pedestrians to select pathways that will guide them towards openings and away from structures that would cause injury. Avoidance behaviours can be affected by fundamental differences in an object's movement (e.g., stationary vs. moving) and/or physical (e.g., human vs. non-human) characteristics. The ability to perceive an object's characteristics and make appropriate behavioural adjustments to avoid collisions is critical to safe locomotion in a dynamically changing environment. My research examines safe human locomotion in cluttered environments, which is affected by the dynamics between the person and the environment, such that changes to the person and/or the environment should result in a change in actions. My presentation will focus on the manner in which people interact with other pedestrians, the control of the experimental variables, and their evolution in time. Crowd simulation started with most basic agents represented as charged particles that move according to a model of local interaction. The presentation will present several examples of such model applications, including architecture design, autonomous vehicle control, crowd management and safety, visual effects for movies or video games. The simulation of human navigation, and by extension, crowd simulation, is a very active research field with a wide range of applications, including architecture design, autonomous vehicle control, crowd management and safety, visual effects for movies or video games. Research in Human Movement Science (HMS) is a great source of inspiration for the design of new simulation models and algorithms. This presentation will give an overview of the research questions addressed in the field of crowd simulation, and how they connect to HMS. A specific category of crowd simulation algorithms, called microscopic approaches, simulate a crowd as a set of agents moving independently, and interacting together. Each agent is equipped with a set of rules that reproduce the way humans navigate in their environment. More specifically, agent influence one another motion according to the a model of local interaction. The presentation will present several examples of such model of interaction, and explain their evolution in time. Crowd simulation started with most basic agents represented as charged particles, progressively moving toward more evolved agents equipped with simulated perception systems, and capable of controlling their motion to what they virtually perceive. The benefit of transcultural approaches - including the role of HMS - will be highlighted and discussed. We will conclude the presentation by listing the questions remaining open in the field.
This presentation will outline findings from the literature including from our longitudinal study of risk factors and circumstances of falls in middle aged women (PreFALL). We will also describe more novel methods (functional near infrared spectroscopy) currently being trialled to understand and assess falls risk in healthy populations. METHODS PreFALL is a cohort of women who were assessed in 2011-12 on a number of factors including lower limb muscle strength and balance. In 2017, two hundred and eight women returned (average age=55 years; range 42-63) for a comprehensive falls risk assessment including balance, mobility, strength, cognition, depression, physical activity, fear of falling and incontinence. Falls and their circumstances were ascertained prospectively via questionnaire over 12 months. RESULTS We will present the results of the PreFALL study that shows balance and mobility begin attenuating in midlife. We will also present the incidence and circumstances of falls and the factors that predict them. The second half of this presentation will outline the role of functional near infrared spectroscopy and its potential in predicting falls in healthy populations. CONCLUSIONS Our findings indicate that falls are not only a problem in older age, but also in middle age. Like in the fields of cardiology or even dementia, where factors in midlife are used in the prediction (and ultimately prevention) of future disease, a focus on falls prevention in midlife should be considered a key component of maintaining good health into older age.

S.5: Falls prevention should start in middle age - Lessons on prevention from cardiology may advance fall prevention in old age

Chair: Stephen Lord  Neuroscience Australia, AUS
Location: Sidlaw suite (level 3)

Is the middle-aged patient still a Jedi? Estimating declines in capacities required to successfully respond to a perturbation while walking

James Richardson¹
University of Michigan

BACKGROUND AND AIM: The ability to respond successfully to a perturbation while walking, during the approximate 350 ms available, requires near optimal neuromuscular and/or short latency neurocognitive functions. Clinicians and patients can be falsely reassured that these essential neuromuscular and neurocognitive attributes are fully intact if the patient does not report falling. However, this is no more valid than concluding that a patient has no cardiac risk factors if s/he has not yet had a myocardial infarction. Therefore the aim of this presentation is to present one possible model of perturbation response, and to provide evidence that the essential neuromuscular and neurocognitive attributes upon which this response model depends (distal proprioceptive precision, short latency inhibitory processing, simple processing speed, and rate of torque generation in proximal muscles) decline in a sub-clinical manner during the middle years of life. We propose that this early decline can lead to falls later in life, analogous to the insidious progression of known cardiac risk factors which can lead to later life myocardial infarction. METHODS: Nerve conduction studies, the most objective measure of peripheral neuromuscular function, are known to decline during mid-life. These will be correlated with a laboratory-based means for determining frontal plane foot/ankle proprioceptive thresholds, with special reference to nerve conduction parameters in the fully normal range. Additionally, a novel means for determining short latency (400 ms) inhibitory processing accuracy and simple reaction time will be evaluated across mid-life age groups. RESULTS: Nerve conduction studies in healthy subjects without neuropathy demonstrate negative correlations with frontal plane foot/ankle proprioceptive precision, (R²p = -.737/002 and -494/061 for fibular conduction velocity (m/s) and amplitude (mV), respectively). Additionally, short latency inhibitory processing accuracy and simple reaction time decline with age in healthy subjects younger than 50 years old (R²p = .436/004 and 338/027, respectively). CONCLUSIONS: Clinicians and patients often do not detect subtle decrements in neuromuscular and neurocognitive functions which appear to begin before age 50, but appear to have functional relevance with regard to the deceptively athletic capacity to successfully respond to a perturbation while walking. However, the evidence presented suggests that with further prospective work we may be able to arm clinicians with tools sufficiently sensitive to detect these subtle declines, and in so doing track fall risk factors from mid-life on as is currently done for cardiac disease, allowing intervention before the "falling disease" becomes manifest.

What people can do and what they actually do: Self-efficacy in the self-management of falls prevention

Mirjam Pijnappels¹
VU Universiteit Amsterdam

BACKGROUND AND AIM: Gait characteristics on the quantity and quality daily life gait relate to falls and discriminate between people at risk of falls, already at late midlife. This relation between gait risk and falls appears modulated by self-perceived gait stability. An inadequate perception of one’s own abilities may result in selecting inappropriate motor behaviour strategies and errors in daily life tasks could lead to falls. Age-related physical and cognitive decline might augment an inadequate self-efficacy. This presentation will focus on disparities between self-perceived and actual physical abilities in stepping tasks and how a mismatch between what people can do and what they actually do can be derived from daily life gait characteristics; as well as on a new paradigm to detect such disparities in healthy older populations. METHODS: In the VIBE study, 284 relatively healthy older individuals (65 years and older) were tested on their physical abilities, self-perceived abilities and cognitive performance at baseline and after one year. They also wore an accelerometer on their lower back twice for one week, to monitor the amount of daily life physical activities, and to quantify daily life gait characteristics. During the 12 month follow-up period, the incidence of falls and participants’ self-efficacy and health status was monitored monthly using questionnaires and telephone calls. A subsample of the VIBE cohort performed additional measurements in a stepping paradigm, as to capture participants’ self-perceived ability in their motor behaviour strategies when selecting either a heel or toe landing when stepping down levels changes of different heights. RESULTS: Outcomes of measures of participants’ actual and self-perceived abilities will be presented, as well as their daily life amount and quantity of daily life gait. We observed disparities on the individual level between participants’ actual abilities and their motor behaviour reflecting their self-perceived ability, as well as in their physical activity characteristics. CONCLUSIONS: People seem not to all select motor behavioral strategies and physical activities levels according to their actual abilities. Although these behavioral choices seem task and time-specific, they may indicate a higher risk of falling in the case of overestimation. Underestimation might induce a lower risk of falling due to inactivity and avoidance of exposure to challenging situations, at least on the short term (commonly evaluated over one year). However, on the longer term, it may boost physical and functional decline and increase risk of falls as a consequence of unsuccessful ageing. Active ageing may be hard to achieve without an increase in fall risk. Yet, similar to cardiac risk factors, people should be aware of the their short and long term fall risk and be educated from early ages on how to monitor their self-efficacy in self-management of preventing falls.

S.5i

S.5ii

Falls in middle age - A neglected issue?

Michele Callisaya¹
University of Tasmania

BACKGROUND AND AIM: Falls are a major health issue causing considerable injury, morbidity and mortality. Most work to date on falls prevention has occurred in older adults (>65 years) with approximately 1 in 3 community-dwelling older people falling each year. We have shown a similar incidence of falls in both men (29.4%) and women (44.7%) of ‘late’ middle-age (60-64 years). Others have reported an incidence of falls in middle age (age 45-64 years) as high as 1 in 6 in a 3-month period. However this middle-aged group of women has largely been ignored in the context of falls prevention.

S.5iii

What people can do and what they actually do; Self-efficacy in the self-management of falls prevention
**SYMPOSIA ABSTRACTS**

**S.5iv**  
**Modifiable fall risk factors and the application of personalized medicine**  
Kim Delbaere¹  
¹Neuroscience Research Australia, UNSW

**BACKGROUND AND AIM.** Aging encompasses functional and structural changes in both central and peripheral sensorimotor systems, with substantial impacts on stability and falls. The ability to stay upright requires coordination of sensory and neuromuscular systems, as well as higher-level cognitive processing. Furthermore, certain affective parameters, such as depression and fear of falling, may also influence fall risk. 

In this talk, the authors will discuss how sub-optimal age-related changes in specific physical, affective and cognitive parameters affect fall risk and preventative strategies. METHODS: 1,203 participants (71±13yrs; 655 older people and 703 people with balance disorders (dementia, N=175; multiple sclerosis, N=210; Parkinson’s disease, N=318) have been tested on sensorimotor function, cognitive function and affect and were followed up for falls. RESULTS: Concomitant deficiencies in physical, affective and cognitive function are common in normal aging. An increased risk of falling is often the result of an accumulation of sub-clinical, non-symptomatic processes that summate over time across this triad. At the same time, a range of diseases and age-related health conditions can also cause physical disability that increases fall risk. Our results confirm that deficits in cognition (executive function) and affect (depressive symptoms, fear of falling) are at least equally important as sensorimotor function for fall prediction and should therefore be included in fall-risk assessments. A suite of reliable and sensitive clinical measures have been identified that detect subtle changes in peripheral neuromuscular function, cognitive processing speed, and psychological distress; and guide a more tailored approach to fall prevention. CONCLUSIONS: Normal aging is associated with changes in gait and increased risk of falling. Mental and physical capacities are even more strongly affected in people with Parkinson’s disease, Alzheimer’s disease, or a history of stroke, as their disease symptoms progress. Targeted fall prevention strategies are important in older people at high risk of falls; however, similar to ‘healthy ageing’, fall prevention should not abruptly start at the age of 65. Fall prevention strategies should be adopted at younger ages; for example by maintaining physically and mentally active lifestyles. Fall risk profiling should be used to identify long-term risk factors and offer guidance towards lifestyle changes (e.g. exercise), preventative medical treatment (e.g. cataract) and education. Crucially, the general public, as well as clinicians, need to recognize falls are not an inevitable consequence of old age and understand their risk factor profile in the same manner many people currently know their cardiac risk factors. The application of personalized medicine guided by basic principles for self-management should be the next frontier in fall risk management.

**S.6i**  
**The quality & quantity of real-world turns are poorer in prospective fallers**  
Lorenzo Chiani¹, Julia Leach¹, Pierpaolo Palumbo¹, Stefania Bandinelli², Sabato Mellone¹  
¹Alma Mater Studiorum – Università di Bologna, ²Local Health Unit Tuscany Centre

**BACKGROUND AND AIM.** Although turning has been reported as one of the leading activities performed during a fall, and falls during turning result in 8-times more hip fractures than falls during linear gait, the quantity and quality of turns resulting in falls remain unknown since turns are rarely assessed during activities of daily living. Our hypothesis is that turning difficulty is an early sign of balance instability and may be indicative of elevated fall risk. METHODS: We used in-home activity monitoring methods to investigate the relationship between turning strategies and fall risk in a high-functioning cohort of 160 community-dwelling older adults (a subsample of the InCHIANTI study) (Leach et al., 2018). Turn measures and activity rates were quantified. Fall incidence within 12 months from continuous monitoring defined fall status. RESULTS: Based on the analysis of 718,582 turns we found future recurrent fallers to exhibit both lower turn quantity and quality compared to the future non-single fallers across a one-week monitoring period. Future recurrent fallers turned less often throughout their day and appeared to be less stable during one of the most common turn types (i.e., the 90° turn), as expressed by longer turn durations, lower turn velocities, and more steps utilized to complete the turn. Additionally, recurrent fallers walked slower, walked/turned less, and were more sedentary throughout their day. There was no difference in the overall active rate between the two groups, suggesting that impaired gait and turning ability, specifically, may have served as a significant contributing factor to the elevated fall risk within this cohort. CONCLUSIONS: Given the fact that 90° turn is the most unstable type of turn neurorehabilitation could focus on modifying turning strategies for 90° turns, with an emphasis on scaling turning speeds at different speeds of walking. Assessment tools targeting turning ability should also be adopted (e.g., the L-Test). If instrumented, as in the instrumented Timed Up and Go test, turn quality could be quantified and monitored throughout the duration of rehabilitation. Assessing turn quality via wearable sensors would indeed enable one to determine the efficacy of specific intervention strategies. Since directly impacting and improving turning ability lies in the forefront of our efforts to prevent future falls, adopting a neurorehabilitation approach with quantitative capabilities is essential.

**S.6: Turning as measure of functional mobility: When biomechanics, neural control, and technology come together**

**Chairs: Martina Mancini Oregon Health & Science University, USA**  
Fay Horak Oregon Health & Science University, USA

**Location:** Pendant suite (level 3)

**How is turning different from straight ahead gait, how we think it is structured, and how it can be enhanced**  
Marco Schieppati¹  
¹International University of Health, Exercise and Sports, LUNEX University

**BACKGROUND AND AIM.** Aging encompasses functional and structural changes in both central and peripheral sensorimotor systems, with substantial impacts on stability and falls. The ability to stay upright requires coordination of sensory and neuromuscular systems, as well as higher-level cognitive processing. Furthermore, certain affective parameters, such as depression and fear of falling, may also influence fall risk. These changes often affect functional mobility, which is commonly quantified through the Timed Up and Go test. METHODS: 1,203 participants (71±13yrs; 655 older people and 703 people with balance disorders (dementia, N=175; multiple sclerosis, N=210; Parkinson’s disease, N=318) have been tested on sensorimotor function, cognitive function and affect and were followed up for falls. RESULTS: Concomitant deficiencies in physical, affective and cognitive function are common in normal aging. An increased risk of falling is often the result of an accumulation of sub-clinical, non-symptomatic processes that summate over time across this triad. At the same time, a range of diseases and age-related health conditions can also cause physical disability that increases fall risk. Our results confirm that deficits in cognition (executive function) and affect (depressive symptoms, fear of falling) are at least equally important as sensorimotor function for fall prediction and should therefore be included in fall-risk assessments. A suite of reliable and sensitive clinical measures have been identified that detect subtle changes in peripheral neuromuscular function, cognitive processing speed, and psychological distress; and guide a more tailored approach to fall prevention. CONCLUSIONS: Normal aging is associated with changes in gait and increased risk of falling. Mental and physical capacities are even more strongly affected in people with Parkinson’s disease, Alzheimer’s disease, or a history of stroke, as their disease symptoms progress. Targeted fall prevention strategies are important in older people at high risk of falls; however, similar to ‘healthy ageing’, fall prevention should not abruptly start at the age of 65. Fall prevention strategies should be adopted at younger ages; for example by maintaining physically and mentally active lifestyles. Fall risk profiling should be used to identify long-term risk factors and offer guidance towards lifestyle changes (e.g. exercise), preventative medical treatment (e.g. cataract) and education. Crucially, the general public, as well as clinicians, need to recognize falls are not an inevitable consequence of old age and understand their risk factor profile in the same manner many people currently know their cardiac risk factors. The application of personalized medicine guided by basic principles for self-management should be the next frontier in fall risk management.

**S.6ii**  
**The quality & quantity of real-world turns are poorer in prospective fallers**  
Lorenzo Chiani¹, Julia Leach¹, Pierpaolo Palumbo¹, Stefania Bandinelli², Sabato Mellone¹  
¹Alma Mater Studiorum – Università di Bologna, ²Local Health Unit Tuscany Centre

**BACKGROUND AND AIM.** Although turning has been reported as one of the leading activities performed during a fall, and falls during turning result in 8-times more hip fractures than falls during linear gait, the quantity and quality of turns resulting in falls remain unknown since turns are rarely assessed during activities of daily living. Our hypothesis is that turning difficulty is an early sign of balance instability and may be indicative of elevated fall risk.

**METHODS:** We used in-home activity monitoring methods to investigate the relationship between turning strategies and fall risk in a high-functioning cohort of 160 community-dwelling older adults (a subsample of the InCHIANTI study) (Leach et al., 2018). Turn measures and activity rates were quantified. Fall incidence within 12 months from continuous monitoring defined fall status.

**RESULTS:** Based on the analysis of 718,582 turns we found future recurrent fallers to exhibit both lower turn quantity and quality compared to the future non-single fallers across a one-week monitoring period. Future recurrent fallers turned less often throughout their day and appeared to be less stable during one of the most common turn types (i.e., the 90° turn), as expressed by longer turn durations, lower turn velocities, and more steps utilized to complete the turn. Additionally, recurrent fallers walked slower, walked/turned less, and were more sedentary throughout their day. There was no difference in the overall active rate between the two groups, suggesting that impaired gait and turning ability, specifically, may have served as a significant contributing factor to the elevated fall risk within this cohort.

**CONCLUSIONS:** Given the fact that 90° turn is the most unstable type of turn neurorehabilitation could focus on modifying turning strategies for 90° turns, with an emphasis on scaling turning speeds at different speeds of walking. Assessment tools targeting turning ability should also be adopted (e.g., the L-Test). If instrumented, as in the instrumented Timed Up and Go test, turn quality could be quantified and monitored throughout the duration of rehabilitation. Assessing turn quality via wearable sensors would indeed enable one to determine the efficacy of specific intervention strategies. Since directly impacting and improving turning ability lies in the forefront of our efforts to prevent future falls, adopting a neurorehabilitation approach with quantitative capabilities is essential.
Turning deficits in patients with Parkinson’s disease and the role of the prefrontal cortex during turning
Inbal Maida1, Anat Mirelman, Jeffrey Hausdorff²
¹Tel Aviv Medical Center

BACKGROUND AND AIM. Turning has been implicated as a complex task that requires both motor and cognitive resources. For patients with Parkinson’s disease (PD), turning impairments are common features of gait disturbances, even in early stages of the disease, that are exacerbated with disease progression and can be a trigger for freezing of gait, falls, and reduced independence. Previous studies documented motor changes of turning in PD including impaired axial coordination, reduction of spatial gait parameters, a greater number of steps, and more time to complete a turn. In contrast, the role of cognition in performing turns is more controversial. Intuitively, one could suggest that turning ability and the recruitment of the prefrontal region would be mediated by cognitive abilities mainly associated with motor planning and attention. Indeed, some evidence suggests that turns become slower and less efficient in the presence of a cognitive load, supporting the idea that turns demand attention and prefrontal activation, however, this evidence is indirect. Therefore, the aim of this work is to provide direct evidence on the role of prefrontal cortex during turns in PD patients.

METHODS AND RESULTS. Prefrontal activation during turns was investigated using functional near infra-red spectroscopy (fNIRS) in patients with PD. Interestingly, we found that PD patients use the prefrontal cortex during turning to a lesser extent than during straight-line walking. In addition, the degree of prefrontal activation during turning was related to background motor abilities, in particular ambulation function, showing that patients with better mobility recruited less activation than patients with worse mobility. Moreover, another study that included patients with freezing of gait (FOG), we observed that during turns with freezing, i.e., unsuccessful turns, prefrontal cortex activation increased, compared to straight-line walking. In contrast, during turns without freezing, i.e., successful turns, prefrontal activation decreased, compared to straight-line walking.

CONCLUSIONS. These findings demonstrate that during turning the prefrontal cortex plays a different role from straight line walking that may depend on the motor abilities of the patient. Higher prefrontal activation during turning in patients with relatively worse ambulation and FOG may reflect a compensatory attempt at improving turning performance. This possibility is consistent with a proposed model of gait failures in PD which posits that in the presence of reduced motor automaticity and poor gait, cognitive resources, in particular prefrontal regions, are called into play in attempt to compensate for these motor deficits. These findings suggest that improving ambulation in patients may increase the efficiency of brain activation by reducing prefrontal activation. Futures studies should examine activation in other brain regions and in response to specific interventions that target motor abilities.

Rehabilitation treatment for turning: Role of wearable technology
Martina Mancini¹, Samuel Stuart¹, Fay Horak¹, Laurie King¹
¹Oregon Health & Science University

NEARLY EVERY TASK PERFORMED DURING THE DAY REQUIRE SOME AMOUNT OF TURNING [1]. DIFFICULTY IN TURNING DURING GAIT IS A MAJOR CONTRIBUTOR TO MOBILITY LIMITATIONS, FALLS AND REDUCED QUALITY OF LIFE IN OLDER PEOPLE AND PEOPLE WITH MOVEMENT DISORDERS (E.G. PARKINSON’S DISEASE). HOWEVER, FALLS DURING TURNING ARE PARTICULARLY DANGEROUS AS THEY OFTEN RESULT IN CONFLICT WITH THE FLOOR, WHICH ENSURES A STOP IN THE CURRENT DIRECTION. TURNING IS INEVITABLE AS THE SYSTEM NEEDS TO CONSERVE ENERGY AND AVOID COMPLEX MOVEMENTS. THE ABILITY TO MODIFY OUR Locomotor trajectory by turning safely is important for functional independence but, surprisingly, turning is much more difficult for the nervous system to control than straight-ahead walking. It has been suggested that neural systems related to turning may be more vulnerable to impairments than those related to straight-ahead gait since turning involves more inter-limb coordination, more coupling between posture and gait, and modifications of locomotor patterns requiring frontal lobe cognitive and executive function that plays a role in postural transitions. Based on those impairments, a rehabilitation program for turning should include components of: coordination (inter-limb, temporal, spatial), consistency (reducing variability), challenge (speed, direction, sensory input, cognitive challenges). This guided discussion will review rehabilitation programs that target different aspects, such as muscle flexibility, weight shifting, coordination, and open-loop external cueing to improve turning outcomes. In parallel, we will also review the potential of wearable technology to improve rehabilitation programs outcomes by 1) providing objective measures at the impairment level, 2) providing a greater sensitivity to detect subtle changes in turning and 3) providing data on turning during regular daily function (home monitoring). Lastly, wearable technology could also be of help in providing patients with feedback about their performance during the rehabilitation session (closed-loop cueing).

Postural threat and standing balance control: Do changes in attention play a role?
Martin Zaback¹
¹University of British Columbia

Postural threat, manipulated through changes in surface elevation, has been used to examine how fear of falling influences balance control. When standing at the edge of an elevated surface, individuals typically lean away from the platform edge and demonstrate higher frequency and smaller amplitude postural adjustments [1]. While these threat-related changes in standing behaviour have been consistently replicated, the underlying mechanisms are not well understood. One theory

The role of movement specific reinvestment in attention focus and gait behaviour by older adults
Liis Uiga¹
¹University of Waikato

BACKGROUND AND AIM. The Theory of Reinvestment (Masters, 1992; Masters & Maxwell, 2008) argues that using consciously step-by-step movement processes to control the movement mechanics online can disrupt performance of relatively automated motor skills. Conscious movement processing (i.e., movement specific reinvestment) is a function of personality, specific context of the task and a variety of psychological, physiological and environmental contingent triggers. As such, the propensity for movement specific reinvestment varies from one person to another and from one context to the next. The aim of this presentation is to provide the theoretical underpinnings of movement specific reinvestment and its association with gait behaviour in older adults.

METHODS. Empirical research conducted in our laboratory examining gait behaviour by older adults will be introduced. RESULTS. We have shown that older adults with a high propensity for movement specific reinvestment are more aware of their limb movements and less aware of the external environment when walking on ground level and/or navigating obstacles, whereas, older adults with a low propensity for movement specific reinvestment are less aware of their limb movements and more aware of the external environment. High inclination for movement specific reinvestment has been further associated with less accurate stepping, despite increased preparation and planning times.

CONCLUSIONS. As conscious processes are slow and attention demanding, it is possible that older adults with a high inclination for movement specific reinvestment are more aware of their limb movements and less aware of the external environment. High inclination for movement specific reinvestment has been further associated with less accurate stepping, despite increased preparation and planning times.

Detailed verbal instructions that cause conscious movement processing. As such, the propensity for movement specific reinvestment varies from one person to another and from one context to the next. The aim of this presentation is to provide the theoretical underpinnings of movement specific reinvestment and its association with gait behaviour in older adults.

METHODS. Empirical research conducted in our laboratory examining gait behaviour by older adults will be introduced.

RESULTS. We have shown that older adults with a high propensity for movement specific reinvestment are more aware of their limb movements and less aware of the external environment when walking on ground level and/or navigating obstacles, whereas, older adults with a low propensity for movement specific reinvestment are less aware of their limb movements and more aware of the external environment. High inclination for movement specific reinvestment has been further associated with less accurate stepping, despite increased preparation and planning times.

CONCLUSIONS. As conscious processes are slow and attention demanding, it is possible that older adults with a high inclination for movement specific reinvestment are more aware of their limb movements and less aware of the external environment. High inclination for movement specific reinvestment has been further associated with less accurate stepping, despite increased preparation and planning times.

Detailed verbal instructions that cause conscious movement processing. As such, the propensity for movement specific reinvestment varies from one person to another and from one context to the next. The aim of this presentation is to provide the theoretical underpinnings of movement specific reinvestment and its association with gait behaviour in older adults.

METHODS. Empirical research conducted in our laboratory examining gait behaviour by older adults will be introduced.

RESULTS. We have shown that older adults with a high propensity for movement specific reinvestment are more aware of their limb movements and less aware of the external environment when walking on ground level and/or navigating obstacles, whereas, older adults with a low propensity for movement specific reinvestment are less aware of their limb movements and more aware of the external environment. High inclination for movement specific reinvestment has been further associated with less accurate stepping, despite increased preparation and planning times.

CONCLUSIONS. As conscious processes are slow and attention demanding, it is possible that older adults with a high inclination for movement specific reinvestment are more aware of their limb movements and less aware of the external environment. High inclination for movement specific reinvestment has been further associated with less accurate stepping, despite increased preparation and planning times.

Detailed verbal instructions that cause conscious movement processing. As such, the propensity for movement specific reinvestment varies from one person to another and from one context to the next. The aim of this presentation is to provide the theoretical underpinnings of movement specific reinvestment and its association with gait behaviour in older adults.

METHODS. Empirical research conducted in our laboratory examining gait behaviour by older adults will be introduced.

RESULTS. We have shown that older adults with a high propensity for movement specific reinvestment are more aware of their limb movements and less aware of the external environment when walking on ground level and/or navigating obstacles, whereas, older adults with a low propensity for movement specific reinvestment are less aware of their limb movements and more aware of the external environment. High inclination for movement specific reinvestment has been further associated with less accurate stepping, despite increased preparation and planning times.

CONCLUSIONS. As conscious processes are slow and attention demanding, it is possible that older adults with a high inclination for movement specific reinvestment are more aware of their limb movements and less aware of the external environment. High inclination for movement specific reinvestment has been further associated with less accurate stepping, despite increased preparation and planning times.
is that emotionally-evoked neurophysiological changes are responsible. Support for this theory comes from research that has demonstrated facilitation of balance relevant vestibular and proprioceptive reflexes when standing under conditions of height-related postural threat [2-4], as well as increased cortical processing of balance relevant sensory inputs [5]. Such changes in sensorimotor set could contribute to the tighter regulation of standing balance typically observed when threatened. Alternatively, threat-related changes in standing balance may be influenced by changes in cognitive strategy. Recent work has demonstrated that there are broad changes in attention when standing under conditions of postural threat; individuals tend to dwell on threat-related stimuli, employ various self-regulatory strategies, and engage in greater conscious movement processing [6-8]. The latter is of particular interest, as redirecting attention toward one's movements may interact with otherwise automatic postural control processes, potentially influencing standing behaviour [9].

This presentation will discuss recent work from our lab that has examined associations between threat-related changes in conscious movement processing and standing balance control, along with existing work that has examined how the manipulation of attention influences standing balance under non-threatening as well as threatening conditions. Discussion will also focus on how known neurophysiological and attentional changes associated with threat may interact to influence standing behaviour. The overall aim of this presentation will be to provide insight into whether changes in attention represent an important mechanism underlying the relationship between postural threat and standing balance control.

REFERENCE

### S.7iv

**Attentional control strategies for retraining gait and balance control in rehabilitation: One size fits all?**

**Elmar Kal¹**

**York University**

**BACKGROUND AND AIM:** Considerable evidence from basic science suggests that conscious movement processing can disrupt motor performance in healthy adults and elderly. This finding could have important ramifications for clinical practice, as it implies that therapists should try to discourage their patients from using conscious control while moving. This may be especially appropriate for patients with stroke or Parkinson’s, and elderly fallers. These clinical groups often report a particularly strong tendency to rely on conscious movement processing in daily life. METHODS: Focusing specifically on stroke rehabilitation, this presentation will try to answer whether (and how) the negative effects of conscious movement processing on motor performance translate to the clinical setting. For a comprehensive assessment, the presentation will first describe the results of observations regarding how physical therapists currently use internal focus strategies (which promote conscious control) when treating patients with stroke. Second, experimental studies will be discussed that have investigated the immediate and long-term effects of learning using internal focus strategies across a range of motor tasks (e.g., stepping, balancing, reaching). RESULTS: Combined, results of these studies challenge the notion that conscious motor processing is fundamentally maladaptive per se. Rather, converging evidence shows that an individual’s motor skill, proprioception, and attentional capacity can partially determine whether an internal, conscious strategy will benefit or disrupt motor performance. For example, a recent randomised trial suggests that conscious processing may actually disrupt balance when patients have relatively intact proprioceptive and motor control, and might actually be beneficial in individuals with impairments in these areas. CONCLUSIONS: To conclude, anxiety-induced changes in attentional control may sometimes be adaptive in people with movement difficulties. It may be appropriate for therapists to screen their patients’ motor, proprioceptive and cognitive skills to be better able to adapt their use of instructions to the individual patient.

### S.8

**Data analytics in the wild: Translating emerging wearable inertial and camera methods to fall prevention intervention strategies**

**Chairs:** James Tung  
University of Waterloo, CAN

**Alan Godfrey**  
Northumbria University, GBR

**Location:** Fintry suite (level 3)

### S.8i

**Digital gait biomarkers beyond the laboratory: Advantages and challenges**

**Silvia Del Din¹**

**Newcastle University**

Digital gait biomarkers are emerging as a powerful tool to detect early disease and monitor progression across a number of conditions. Typically, quantitative gait assessment has been limited to specialised laboratory facilities. However, measuring gait in home and free-living/community settings may provide a more accurate reflection of gait performance as it allows walking activity to be captured over time in habitual contexts. Modern accelerometer-based wearable technology allows objective measurement of digital gait biomarkers, comprising metrics of free-living walking activity/behaviour as well as discrete gait characteristics. This presentation will address the feasibility, advantages and challenges of measuring digital gait outcomes during free-living activity for discriminating pathology and detecting early risk. The use of traditional digital gait outcomes and novel metrics as a measurement tool for characterising patient populations, discriminating disease (e.g. Parkinson’s disease) and detecting risk (e.g. prodromal stage of disease) will also be discussed. Data driven approaches for disease classification and progression will also be presented. Quantification of digital gait outcomes in free-living/unsupervised environments presents considerable challenges due to: sensor limitations; lack of standardised protocols; definitions and outcomes; engineering challenges; and contextual recognition. However our preliminary results are encouraging regarding the use of digital gait biomarkers for application in large multi-centre clinical trials, for supporting diagnosis and guiding clinical decision making.

### S.8ii

**Attentional control strategies for retraining gait and balance control in rehabilitation: One size fits all?**

**Elmar Kal¹**

**York University**

**BACKGROUND AND AIM:** Considerable evidence from basic science suggests that conscious movement processing can disrupt motor performance in healthy adults and elderly. This finding could have important ramifications for clinical practice, as it implies that therapists should try to discourage their patients from using conscious control while moving. This may be especially appropriate for patients with stroke or Parkinson’s, and elderly fallers. These clinical groups often report a particularly strong tendency to rely on conscious movement processing in daily life. METHODS: Focusing specifically on stroke rehabilitation, this presentation will try to answer whether (and how) the negative effects of conscious movement processing on motor performance translate to the clinical setting. For a comprehensive assessment, the presentation will first describe the results of observations regarding how physical therapists currently use internal focus strategies (which promote conscious control) when treating patients with stroke. Second, experimental studies will be discussed that have investigated the immediate and long-term effects of learning using internal focus strategies across a range of motor tasks (e.g., stepping, balancing, reaching). RESULTS: Combined, results of these studies challenge the notion that conscious motor processing is fundamentally maladaptive per se. Rather, converging evidence shows that an individual’s motor skill, proprioception, and attentional capacity can partially determine whether an internal, conscious strategy will benefit or disrupt motor performance. For example, a recent randomised trial suggests that conscious processing may actually disrupt balance when patients have relatively intact proprioceptive and motor control, and might actually be beneficial in individuals with impairments in these areas. CONCLUSIONS: To conclude, anxiety-induced changes in attentional control may sometimes be adaptive in people with movement difficulties. It may be appropriate for therapists to screen their patients’ motor, proprioceptive and cognitive skills to be better able to adapt their use of instructions to the individual patient.

### S.8

**Data analytics in the wild: Translating emerging wearable inertial and camera methods to fall prevention intervention strategies**

**Chairs:** James Tung  
University of Waterloo, CAN

**Alan Godfrey**  
Northumbria University, GBR

**Location:** Fintry suite (level 3)

### S.8i

**Digital gait biomarkers beyond the laboratory: Advantages and challenges**

**Silvia Del Din¹**

**Newcastle University**

Digital gait biomarkers are emerging as a powerful tool to detect early disease and monitor progression across a number of conditions. Typically, quantitative gait assessment has been limited to specialised laboratory facilities. However, measuring gait in home and free-living/community settings may provide a more accurate reflection of gait performance as it allows walking activity to be captured over time in habitual contexts. Modern accelerometer-based wearable technology allows objective measurement of digital gait biomarkers, comprising metrics of free-living walking activity/behaviour as well as discrete gait characteristics. This presentation will address the feasibility, advantages and challenges of measuring digital gait outcomes during free-living activity for discriminating pathology and detecting early risk. The use of traditional digital gait outcomes and novel metrics as a measurement tool for characterising patient populations, discriminating disease (e.g. Parkinson’s disease) and detecting risk (e.g. prodromal stage of disease) will also be discussed. Data driven approaches for disease classification and progression will also be presented. Quantification of digital gait outcomes in free-living/unsupervised environments presents considerable challenges due to: sensor limitations; lack of standardised protocols; definitions and outcomes; engineering challenges; and contextual recognition. However our preliminary results are encouraging regarding the use of digital gait biomarkers for application in large multi-centre clinical trials, for supporting diagnosis and guiding clinical decision making.
Fall risk assessment with wearables in the wild: Towards recommended free-living outcomes
Mina Nouredanesh¹, Alan Godfrey², James Tung¹
¹University of Waterloo, ²Northumbria University
Current wearables, largely inertial measurement unit-based devices (IMUs, e.g. accelerometer, gyroscope) have been used to quantify a range of physical functioning/capability related tasks. Most notable are gait related activities such as intermittent and continuous (predetermined timed, e.g. 2 minutes) walking during clinical/laboratory-observational-based testing. Other examples include transitions, turns and composite measures of physical capability such as timed-up-and-go (TUG). Utilising IMUs to objectively quantify outcomes during those tasks adopts an instrumented approach which have shown promise for fall risk assessment (FRA) during laboratory-based protocols. Yet, true IMU value resides beyond the laboratory while monitoring more natural, habitual activities. Discrete, high resolution IMUs can gather data continuously in any environment. Current state of the art has primarily focussed on gait assessment during 3 to 7 day studies but notable challenges remain which are also evident during gathering free-living turning, transition and composite related data. Despite the growing body of literature focusing on the development of novel IMU-based free-living FRA methods, there is little consensus on use of language (e.g. quantity vs macro) and outcomes (e.g. spatiotemporal gait, sedentary duration, quantity of missteps). Moreover, this is complicated by the (i) inconsistent inclusion and description of gait outcomes within discrete domains associated with fall prediction (e.g. postural control, pace); (ii) methodological and algorithm descriptions of how gait and other activities are defined from free-living IMU bout segmentation; and (iii) dearth of contextual analysis surrounding IMU captured free-living gait and fall related events. From a detailed narrative literature review, we highlight inconsistencies within the literature while providing recommendations towards the harmonisation and standardization of outcomes for free-living FRA by: (a) proposing a new conceptual framework to map free-living IMU-based outcomes; and (b) identifying outcomes with strong predictive power for falls. Furthermore, current limitations associated with collecting and analyzing free-living IMU-based data only are discussed. Consequently, we introduce the potential of body-worn egocentric cameras to complement IMU data with contextual information (to detect fall-related environmental hazards, circumstance and location) while proposing new approaches to complement existing gait models with outcomes from video data.

Video capture of falls in long-term care from cameras mounted to ceilings and walls: Lessons from an 11 year cohort study
Stephen Robinovitch¹, Natalie Shishov², Vicki Komisar³
Simon Fraser University
For the past 11 years, we have partnered with two long-term care facilities in the Vancouver area in a cohort study of falls. The study involves video footage of real-life falls collected from networks of cameras mounted to ceilings and walls in common areas (dining rooms, hallways and lounges). To date, we have analyzed over 2400 falls experienced by over 650 residents, using structured questionnaires to explore the characteristics of fall initiation, descent, impact and recovery. These validated tools allow us to quantify the activities that older adults were attempting at the time of the fall, the characteristics of the environment, the nature of balance recovery attempts, the direction of the fall, and the body parts experiencing impact during the fall. The size of the database allows us to narrow our focus to examining falls in specific patient subgroups, situational or environmental contexts, or injury outcomes including hip fracture (see Figure). We are now sharing a database of 105 falls for reuse by researchers through the NYU-based Databrary network. Environmental cameras have specific strengths and weaknesses for video capture of falls. Once installed, they do not rely on the user to adopt or wear the technology. They can provide extensive coverage (at a cost) and high resolution images. The external view of the fall facilitates analysis of the time-varying kinematics of the body during falls with video digitization or modelling software. However, each camera only captures movements in it’s field-of-view, and occlusions are common. In contrast, body-mounted cameras can provide continuous footage regardless of location. For any type of video system, the range of feasible outcomes is limited to what can be reliably observed from the video. For example, our questionnaire quantifies the biomechanical nature of imbalance (e.g. misstep, loss of support, etc.), but we cannot determine from the video the physiological factors underlying imbalance. Challenges arise in extracting the intent or thoughts of the individual from video. Body-centric cameras may provide complementary information on head orientation or gaze. Another challenge is automatic detection of events of interest, such as falls (a process that is facilitated in long-term care through incident reports, and the ability to capture weeks or even months of video footage on large hard drives). The development of computer vision techniques to automatically extract a range of useful outcomes from video footage is a worthwhile but challenging goal. Preliminary attempts to detect falls from video footage with machine learning algorithms show about 70% accuracy in detecting falls, but may be higher for body-centric cameras.

Effects of spinal cord stimulation on mobility and cortical activity in Parkinson’s disease
Olivia Samotus¹, Andrew Parrent², Mandar Jog²
¹Neuroscience Research Australia/University of New South Wales
Wearables are becoming ubiquitous for activity tracking and can provide insight into quality of movement. These devices can be used to unobtrusively assess the amount and quality of gait someone engages in during daily life, which has been linked to fall risk. This presentation will provide an overview of the opportunities, challenges and limitations of using wearable sensors in large-scale studies to assess fall risk and mobility decline. It will also discuss how video-based approaches may advance the field. The first part of the presentation will focus on sensitivity of daily-life gait to change, which is essential for use beyond screening. We collected repeated assessments in 169 older people, 2 weeks apart, to assess stability of daily-life gait quality characteristics. Our results show that gait characteristics were comparable (all p > 0.11) and strongly correlated between the two assessments (r = 0.77 to 0.97). Recent work on sensitivity to change over a year as a result of time or a balance exercise intervention will also be discussed. Whilst initial results are promising, the field is still in its infancy. Future work should address standardisation of daily-life gait analysis and rigorous testing of methodology. Video observation might assist in validating some of the underlying assumptions of daily-life gait analysis, as well as provide insight into contextual influences, which cannot readily be assessed with accelerometers. Hence, the second part of the presentation will focus on how wearable and video-based approaches may complement and enrich each other to discuss the future of these techniques to improve efficient use in clinical-based studies.

Effects of spinal cord stimulation on mobility and cortical activity in Parkinson’s disease patients with severe gait dysfunction and ON-freezing
Olivia Samotus¹, Andrew Parrent², Mandar Jog²
¹Neuroscience Research Australia/University of New South Wales
BACKGROUND AND AIM: Axial motor symptoms such as gait dysfunction and freezing of gait (FOG) are highly disabling and result in injuries, and loss of independence and quality of life in Parkinson’s disease (PD) patients. The response of axial motor symptoms to dopaminergic therapy and deep brain stimulation is limited and unpredictable. Individualized programming of epidural spinal cord stimulation (SCS) has been shown to reduce the number of FOG episodes and improve spatiotemporal gait features over 6 months. We investigated how motor cortical excitability is modulated by SCS therapy
for PD gait dysfunction over a 12-month period. METHODS: Mid-thoracic SCS was implanted in 10 PD patients with levodopa-resistant FOG and gait dysfunction. Primary motor intracortical facilitation and inhibition activities were assessed using paired-pulse transcranial magnetic stimulation (pp-TMS) protocols targeting the first dorsal interosseous (FDI) and tibialis anterior (TA) muscles. SCS programming was individualized to each participant’s spatiotemporal gait metrics within the first month post-SCS implantation. Ambulatory and turning gait tasks and pp-TMS measures were collected pre-SCS implantation and at 3, 6-, and 12-months of SCS use while participants were OFF and ON dopaminergic medication.

RESULTS: SCS significantly reduced the number of FOG episodes and improved dynamic postural balance, stride velocity, step-length, single support and swing times acutely (1-hour in the lab with SCS ON) and with chronic SCS use (participants on medication with the SCS turned OFF and ON) compared to pre-SCS. At baseline, impaired intracortical facilitation (ICF) levels in the lower limb cortical areas were correlated to stride length and velocity gait parameters while participants were off medication. ICF levels increased with chronic SCS use while participants were on and on medication. With SCS, short, afferent inhibition levels in the upper limb were improved and correlated to improvements in spatiotemporal gait dynamics. CONCLUSIONS: Observed gait improvements by SCS in PD participants may be governed by enhancing motor cortico-cortical activity.

**S.9ii**

Subthalamic neural signatures of gait impairment and FOG in Parkinson’s disease and the response to 60 Hz and 140 Hz deep brain stimulation

Helen Bronte-Stewart¹, Chioma Anidi¹, Johanna O’Day¹, Ross Anderson³, Muhammad Furqan Afzal¹, Judy Syrkin-Nikolaus¹, Anca Velisar³

¹Stanford University Medical Center

BACKGROUND AND AIM: Freezing of Gait (FOG) is a devastating axial motor symptom in Parkinson’s disease (PD) leading to falls, injury and loss of independent living. The response of FOG to dopaminergic medication and deep brain stimulation (DBS) is complex, variable and yet to be optimized. Fundamental gaps in the knowledge of the underlying neuro-biochemical mechanisms of FOG render this symptom one of the unsolved problems in the treatment of PD. Subcortical neural features of gait impairment and FOG in PD are largely unknown due to the challenge of accessing deep brain circuitry in freely moving human subjects, and due to the difficulty of eliciting FOG. Since FOG is episodic we hypothesized that dynamic features of subthalamic (STN) beta oscillations (beta bursts) may contribute to the freeze phenotype during gait tasks that elicited FOG. We also investigated whether STN DBS at 60 Hz or 140 Hz affected beta burst dynamics and gait impairment differently in Freezers and Non-Freezers. METHODS: Synchronized STN local field potentials from an investigative implanted sensing neurostimulator (Activa® PC+S, Medtronic Inc, FDA IDE, Stanford IRB approved), and gait kinematics/kinetestics were recorded in 12 PD subjects, off medication, during forward walking and stepping in place (SIP on a dual force plates) tasks under the following randomly presented conditions: NO, 60 Hz, and 140 Hz STN DBS. RESULTS: Prolonged movement band beta burst durations differentiated Freezers from Non-Freezers during gait without FOG, and were longer during periods of FOG in Freezers. In Freezers, both 60 Hz and 140 Hz DBS improved gait arrhythmia and shortened burst durations during gait without FOG, reduced the percent time of FOG and shortened burst durations during FOG. In contrast STN DBS at either frequency left unchanged the normal gait parameters and short burst durations in Non-Freezers. CONCLUSIONS: This study demonstrates that prolonged periods of excessive beta oscillations and synchrony (longer beta burst durations) are important neural markers for freezing behavior and FOG in PD and that STN DBS modulates longer not shorter beta burst durations while improving gait arrhythmia and FOG, thereby acting to restore physiological signaling in sensorimotor networks.

**S.9iii**

Behavioral and electrophysiological effects of spinal cord stimulation Parkinson’s disease animal models

Rómulo Fuentes¹, Águiles Martínez¹, María Florencia Alamos²

¹Universidad de CHL, ²Pontificia Universidad Católica de CHL

BACKGROUND AND AIM: Dopamine replacement therapy is effective for treating appendicular symptoms of Parkinson’s disease (PD), but is less effective for axial symptoms like posture and gait impairments. For the first time, we applied the novel use of thoracic spinal cord stimulation (SCS) to restore locomotion and improve freezing, bradykinesia and rigidity in rodents and primate parkinsonian animal models. The objective is to discuss the possible mechanisms of action for SCS of treating gait in parkinsonian disorders. METHODS: In several studies involving different PD animal models, acute pharmacologically induced dopamine-depleted mice, chronic 6-hydroxydopamine (6-OHDA) lesioned rats, rats with alpha-synuclein over expression, and marmosets with 6-OHDA lesion we measured behavioural and electrophysiological responses to SCS. In vivo electrophysiological recordings within the brain motor circuit using local field potential and single neuron were measured before and after SCS was applied. RESULTS: The functional recovery was paralleled by the disruption of the pathological low-frequency synchronous oscillatory activity, leading to an electrophysiological state normally preceding spontaneous initiation of locomotion. Neural activity patterns of dorsolateral striatum and primary motor cortex (MI) were also significantly altered. CONCLUSIONS: These studies suggest that SCS effect is not just due to a local effect on the spinal cord. It seems that SCS can interfere with brain dynamics, leading to states that allow movement. SCS should be considered as an additional treatment option for PD-patients.

**S.10i**

Limitations and opportunities for virtual reality sensorimotor training

Daniel Ferris¹

¹University of Florida

BACKGROUND AND AIM: Previous research using virtual reality for motor skills training has failed to demonstrate it can accelerate or improve training outcomes relative to training in the real world. Sensorimotor training seems to inhibit motor learning compared to practicing the real world task. Potential reasons for the inhibited motor learning are the slow refresh rate of visual displays, disconnect between visual display and vestibular feedback, reduction in peripheral vision, and/or added cognitive load. As a result, many attempts at improving sensorimotor training with virtual reality have not fared well in comparison to real world training. Although there appear to be drawbacks to virtual reality training, there are advantages to using virtual reality that allow for perturbations or manipulations to training that cannot be done in the real world. Although there appear to be added cognitive load. As a result, many attempts at improving sensorimotor training with virtual reality have not fared well in comparison to real world training. Although there appear to be drawbacks to virtual reality training, there are advantages to using virtual reality that allow for perturbations or manipulations to training that cannot be done in the real world. For example, virtual reality can induce added stress safely in a human by modifying the training environment. Walking on a balance beam four stories off the ground is safer and easier to accomplish in virtual reality than in the real world. Another example of training modifications that can be more easily accomplished with virtual reality compared to the real world are virtual perturbation. Introducing transient changes to the visual field with virtual reality can cause individuals to downgrade their dependence on visual feedback and increase their dependence on proprioceptive feedback. These types of virtual reality modifications enable researchers to enhance motor learning outcomes during sensorimotor training. METHODS: My laboratory has studied how electrocortical brain activity (i.e. high-density electroencephalography) and whole body biomechanics change in regard to virtual reality modifications during sensorimotor training. We often use an experimental paradigm of subjects walking on a treadmill-mounted balance beam as it is a functional locomotor task that requires active lateral balancing. With virtual reality, we have been able to modify the sensory feedback to individuals as they practice the sensorimotor locomotor task. RESULTS: Virtual reality modifications can modify physiological parameters during training.
Along with motor learning outcomes after practice, the electrocortical data indicates that the choice in virtual reality modifications can have distinct effects on brain network activity, providing insight into the neurophysiological mechanisms for modified motor learning outcomes. **CONCLUSIONS.** Combining biomechanical and electrocortical measurements during experimental modifications of sensorimotor training with virtual reality can greatly enhance the design of new training approaches. In addition to providing new insight into how the brain controls human movement, the techniques can also inform computer scientists and engineers how they might improve virtual reality systems for enhanced sensorimotor training outcomes.

**S.10i**

**Using simulation technologies to study multisensory self-motion perception and mobility: Effects of age-related changes to sensory and cognitive functions**

Jennifer Campos¹, M. Kathleen Pichora-Fuller², Karen Li³, Natalie Phillips³, Laurence Harris⁴

¹Toronto Rehabilitation Institute - University Health Network, ²University of Toronto, ³Concordia University, ⁴York University

**BACKGROUND** As we move though our environment, our brain integrates visual, auditory, proprioceptive and vestibular inputs. Optimally integrating these inputs allows us to perceive self-movement parameters (e.g. heading direction) with greater certainty. However, much remains to be understood regarding how sensory inputs are integrated in the brain to support mobility and how age-related changes to sensory and cognitive functions affect these processes. Virtual Reality (VR) and simulation technologies are useful tools for multisensory research given the ability to strategically manipulate individually sensory inputs. Further, these technologies can be used to mimic everyday conditions, which is informative when applying fundamental knowledge in multisensory and sensory-cognitive integrative processes to real world mobility-related challenges. First, I will describe Toronto Rehab's Challenging Environment Assessment Laboratory (CEAL) which houses a motion platform, advanced driving simulator and immersive projection-based VR system with treadmill. Second, I will describe studies evaluating sensory-motor-cognitive interactions during tasks of standing balance, walking, and passive motion. **METHODS AND RESULTS.** 1. We evaluated age-related changes to visual-vestibular integration, using the motion platform and a head-mounted display to perform psychophysical head orientation estimation tasks. Results indicate that older and younger adults both demonstrate increased estimate precision from congruent bimodal inputs (visual-vestibular) compared to unmodal inputs (visual or vestibular alone); however, during sensory conflicts (conflicting visual and vestibular heading angles), older adults do not demonstrate vestibular-based sensory weighting as would be predicted by optimal integration. 2. We used the projection-based VR simulator to evaluate standing balance and walking performance during multisensory, multitasking conditions. Specifically, participants either walked or stood within a simulated city scene while either performing an auditory divided attention task or no secondary task. Dual-task costs were evaluated and suggest that mobility-related functions were prioritized; particularly in older individuals with and without hearing loss and older adults at risk of cognitive decline. **CONCLUSIONS** Understanding how sensory inputs are integrated to support mobility helps extend traditional approaches of studying sensory systems independently. Reproducing realistic and challenging conditions can provide novel insights into sensory and cognitive interactions. These processes may change with age-related sensory and cognitive declines. Simulators can provide novel methods of systematically studying the fundamentals of multisensory integration and can provide an important middle ground between traditional labs/clinics (controlled/safe) and the real world (uncontrolled/dangerous). Funding: NSERC, CIHR, Alzheimer's Association.

**S.10ii**

**Development of low-cost virtual reality applications to assess sensorimotor function and improve real-world mobility**

James Finley¹, Aram Kim², Beth Fisher³, Marientina Gotis³, Vangelis Lymposuridis³

¹University of Southern California

**BACKGROUND AND AIM.** Recent advances in consumer-level virtual reality (VR) have opened the door for the development of low-cost, fully-immersive systems for interactive mobility training. The promise of VR for improving mobility lies in its ability to mimic real-world challenges such as obstacles and crowds while providing systematic control over the environment and augmented performance feedback. However, creating effective training applications requires an understanding of how sensory feedback provided in VR is integrated with ongoing locomotor commands and how the practice of locomotor skills in VR transfers to the real world. Here, I will share recent work from our lab exploring sensorimotor integration and locomotor skill learning in virtual reality, and conclude with a description of how we use this information to develop interactive mobility training experiences. **METHODS.** We first investigated how visual feedback about the lower extremities influenced the coordination between head orientation and foot placement during a treadmill-based virtual obstacle negotiation task. During the task, participants received one of three types of visual feedback about the lower extremities: no feedback, end-point feedback, and a link-segment model. In a second study, we examined how people acquired a novel obstacle negotiation skill in VR and evaluated how this skill transferred to the real-world. Transfer of learning was assessed by measuring how VR-based training influenced participants’ foot clearance during over-ground negotiation of a physical obstacle. We also assessed retention of the learned skill on the treadmill and over-ground 24 hours after the initial session. **RESULTS.** The presence of a visual representation of the lower extremities led to greater downward head pitch during the approach to and subsequent crossing of an obstacle. Moreover, this strategy was associated with increased safety margins during trailing limb crossing. In our study of skill learning, we found that participants systematically learned to reduce foot clearance during the VR trials, and this reduction in foot clearance transferred to over-ground walking. Moreover, this skill was retained in VR and over-ground on Day 2. Lastly, we found that retention in each environment was associated with the final level of performance in the same environment on Day 1. **CONCLUSIONS.** These results demonstrate that the quality of visual information about the lower extremities influences visual-motor coordination during virtual obstacle negotiation. Moreover, we showed that locomotor skills can be learned in VR and the retention of these skills is associated with performance during skill acquisition in a context-dependent manner. Ultimately, gaining a deeper understanding of sensorimotor control and learning in the context of VR is critical for informing the development of effective VR-based clinical interventions to improve mobility.

**S.11i**

**Balance training using perturbations to prevent falls: Is it feasible and effective?**

Chair: Stephen Lord

**Location:** Pentland suite (level 3)

**S.11ii**

**Perturbation training for fall-prevention: Inception, evolution, translation**

Tanvi Bhatt¹

¹University of Illinois at Chicago

Despite the commonality of falls within the community-dwelling aging and disabled population, little is known about their mechanism or their contributing factors, with limited tools assessing this crucial aspect. Further, there are limited evidence-based treatment approaches for fall reduction in these populations. Perturbation training is an emerging, task-specific intervention that exposes individuals to self- or externally-generated perturbations, entraining proactive and reactive control mechanisms for fall prevention. We examined the adaptation and training effects to repeated laboratory-induced perturbations and the ability to generalize their effects to different contexts. Healthy subjects were exposed to repeated moveable platform slip perturbations induced under their right limb and were subsequently exposed to slips under the non-trained limb, non-trained surface (oil contaminated vinyl floor) and non-trained tasks perturbation (trips). We observed that the perturbation-training induced adaptations could be significantly generalized across limbs, functional tasks, and training devices, resulting in reduced fall outcomes on exposure to these novel, non-training environments. Preliminary results indicate that older adults are able to demonstrate similar adaptations and generalizations. Findings from systematic large scale clinical trials indicate in older adults indicate that single-session, training-induced adaptations can be retained in a laboratory setting for up to 12 months with maximum retention at 3 months with a gradual motor memory decay from 6 to 9 to 12 months. To facilitate translation of such training into clinical environments, we subsequently...

**Development of low-cost virtual reality applications to assess sensorimotor function and improve real-world mobility**

James Finley⁎, Aram Kim⁎, Beth Fisher⁎, Marientina Gotis⁎, Vangelis Lymposuridis⁎

⁎University of Southern California

**RESULTS**

After the initial session.**

**NEGOTIATION OF A PHYSICAL OBSTACLE.** We also assessed retention of the learned skill on the treadmill and over-ground 24 hours after the initial session. **RESULTS.** The presence of a visual representation of the lower extremities led to greater downward head pitch during the approach to and subsequent crossing of an obstacle. Moreover, this strategy was associated with increased safety margins during trailing limb crossing. In our study of skill learning, we found that participants systematically learned to reduce foot clearance during the VR trials, and this reduction in foot clearance transferred to over-ground walking. Moreover, this skill was retained in VR and over-ground on Day 2. Lastly, we found that retention in each environment was associated with the final level of performance in the same environment on Day 1. **CONCLUSIONS.** These results demonstrate that the quality of visual information about the lower extremities influences visuomotor coordination during virtual obstacle negotiation. Moreover, we showed that locomotor skills can be learned in VR and the retention of these skills is associated with performance during skill acquisition in a context-dependent manner. Ultimately, gaining a deeper understanding of sensorimotor control and learning in the context of VR is critical for informing the development of effective VR-based clinical interventions to improve mobility.

**S.11i**

**Balance training using perturbations to prevent falls: Is it feasible and effective?**

Chair: Stephen Lord

Neuroscience Research Australia, AUS

Location: Pentland suite (level 3)

**S.11ii**

**Perturbation training for fall-prevention: Inception, evolution, translation**

Tanvi Bhatt¹

¹University of Illinois at Chicago

Despite the commonality of falls within the community-dwelling aging and disabled population, little is known about their mechanism or their contributing factors, with limited tools assessing this crucial aspect. Further, there are limited evidence-based treatment approaches for fall reduction in these populations. Perturbation training is an emerging, task-specific intervention that exposes individuals to self- or externally-generated perturbations, entraining proactive and reactive control mechanisms for fall prevention. We examined the adaptation and training effects to repeated laboratory-induced perturbations and the ability to generalize their effects to different contexts. Healthy subjects were exposed to repeated moveable platform slip perturbations induced under their right limb and were subsequently exposed to slips under the non-trained limb, non-trained surface (oil contaminated vinyl floor) and non-trained tasks perturbation (trips). We observed that the perturbation-training induced adaptations could be significantly generalized across limbs, functional tasks, and training devices, resulting in reduced fall outcomes on exposure to these novel, non-training environments. Preliminary results indicate that older adults are able to demonstrate similar adaptations and generalizations. Findings from systematic large scale clinical trials indicate in older adults indicate that single-session, training-induced adaptations can be retained in a laboratory setting for up to 12 months with maximum retention at 3 months with a gradual motor memory decay from 6 to 9 to 12 months. To facilitate translation of such training into clinical environments, we subsequently...
conducted an RCT to examine adaptation effects induced from treadmill-slip-perturbation training in older adults and their generalization to overground slips. Results indicated that treadmill-slip-perturbation training though effective in inducing reactive adaptations in stability control and reducing fall-risk to novel overground slips was less effective than the task-specific overground slip training. Conversely overground trip-perturbation training though resulted in significant adaptations within a single-session in terms of stability control and obstacle hit, shorter-term retention was not as robust as slip-induced. Further, considerations of optimal dosage for perturbation training will be discussed. Lastly we examined if the adaptive effects observed within a healthy nervous system would be impacted by a neurological insult such as a stroke. Results indicated that upon exposure to overground slips people with hemi-parietic chronic stroke could acquire adaptations in stability control similar to healthy older adults both under affected and non-affected limbs (albeit at different rates) for preventing fall-risk. Given these positive results, perturbation-based assessment and training could be used as an adjunct to current rehabilitation paradigms to target fall-prevention.

S.11ii
Adaptation and retention of reactive gait stability to trip perturbations in older adults
Kiros Karamanidis¹, Epro Gaspar³, Chris McCrurn³, Matthias Köeig³
1London South Bank University, 2Maastricht University Medical Centre+
Gait stability declines and falls incidence increases with age. Most falls among older people occur during gait, often due to tripping or slipping. Thus, the ability to respond appropriately to unexpected external disturbances in the mechanical environment during gait, and to improve and retain such fall-resisting skills are important for preventing falls. Task-specific assessment of gait stability and adaptability, in addition to potential training-induced improvements in the recovery stepping behaviour of older adults, comprise an interesting experimental approach to assess and influence mechanisms that may affect the safety of human gait. In a series of laboratory-based studies, we investigated how gait stability and adaptability during walking with trip-like perturbations are affected by age and muscle-tendon unit mechanical properties, in order to better understand the underlying mechanisms of the decline in locomotor function across the adult lifespan. We demonstrated that the ability to control dynamic stability in response to a novel trip-like perturbation during walking has already begun to deteriorate by middle age, however, even in old age the ability to adapt gait and improve stability following repeated perturbations is preserved. In subsequent studies we showed that leg-extensor muscle strength and tendon stiffness limit gait stability during unexpected, untrained perturbations, but that the potential for adaptive improvement after repeated perturbations during walking seems not to be related to the age-related degeneration in muscle-tendon unit capacities. Concerning the long-term retention of acquired gait stability improvements, we found that the neuro-motor system of older adults is capable of retaining the improved fall-resisting skills over a prolonged time period (years) with minimal decay over time. In summary, our findings support the hypothesis that the aged neuro-motor system can facilitate reactive balance responses by upgrading its neuromuscular coordination and retaining those balance improvements over several years and may thereby reduce the risk of falling. Whether training effects are also translated to other balance tasks will be discussed.

S.11iii
Pursuit of ecological validity in perturbations used for reactive balance training: Studies using the trip and slip walkway in young and older adults
Yoshiro Okubo¹, Matthew Brodie¹, Daina Sturnieks¹, Stephen Lord¹
¹Neuroscience Research Australia
The greater fall reduction effect shown by balance training using perturbations, compared to general exercises, are likely related to the greater task-specificity of the trained movements (Okubo et al., 2017). Ecologically valid perturbations (i.e. similar to real life hazards) may be crucial for training balance to prevent falls. The most common causes of falls among community-dwelling older adults are trips and slips (Berg et al., 1997). Therefore, we developed a walkway that provides unpredictable trips and slips while walking at usual gait speed. We will present results from two pilot experiments and a randomised controlled trial (RCT) using this trip and slip walkway. Our first pilot study with 10 young participants indicated (i) rapid adaptation to a few trials are related to prediction of the perturbation type and location, (ii) gait adaptations based on prediction do not transfer to trips and slips that occur in new, unexpected locations, and (iii) improvement of reactive responses occurs more slowly. The second pilot study with 10 young and 10 older participants indicated that increasingly unpredictable perturbations (i.e. less prediction and more reactive response) resulted in increased anxiety and a 30% dropout in older adults. This indicates training reactive balance in a single session is not optimal and older adults require more staged progression in learning appropriate responses to unpredictable trips and slips. This informed a RCT which involved 44 older adults taking part in three sessions of trips, slips and mixed training (intervention) and sham step-training (control). At post-assessment, relative to the control group, the intervention group experienced -60% fewer total falls (rate ratio [RR]=0.40, 95% confidence interval [CI]=0.22-0.76), -67% fewer slip falls (RR=0.33, 95% CI=0.12-0.90) and -51% fewer trip falls (RR=0.49, 95% CI=0.21-1.12) in the laboratory (Figure 1). These findings indicate older adults can improve reactive responses to trips and slips with high unpredictability. Further research is required to examine its effects in reducing real-life falls and improve clinical feasibility of the training paradigm while maintaining its efficacy and ecological validity.

S.11iv
Can balance training with perturbations actually be implemented in rehabilitation practice?
Avril Mansfield¹, Elizabeth Innes¹
¹University Health Network
Reactive balance training (RBT) with perturbations is a relatively new treatment approach, and lack of awareness and knowledge of new interventions is often the primary barrier to clinical implementation of new practices. Furthermore, specific characteristics of RBT pose challenges for implementation into clinical practice. Most notably, previous studies of RBT usually use custom equipment (e.g., walkways, moving platforms) or programmable treadmills to deliver the perturbations. Lack of time, lack of equipment, poor equipment reliability, and knowledge and skills required to use the equipment are some common barriers to using new treatments in rehabilitation practice when new devices are involved. Therefore, relying on equipment to provide the perturbations may pose a significant challenge to implementing RBT into clinical practice. Additionally, reactive balance control is not assessed routinely in clinical practice, which presents a challenge for identifying client-specific reactive balance dyscontrol that can be targeted with training. We have developed task-oriented RBT methods that do not require specialized equipment, and have implemented these methods into neurorehabilitation practice at our institution for individuals with stroke, acquired brain injury, and spinal cord injury. This presentation will discuss our experiences implementing RBT, results of studies we have conducted evaluating the effect of RBT on reactive balance control and falls in daily life, and results of a survey of healthcare professionals’ use of RBT in clinical practice. Using an integrated knowledge translation approach, working collaboratively with clinical partners, we iteratively developed an approach to outline principles of training (e.g., motor learning and ‘FIT’ principles), inclusion/exclusion criteria and safety considerations, and potential training strategies based on underlying dyscontrol. Our work demonstrates that low-tech RBT is feasible in neurorehabilitation practice, can improve reactive balance control, and has the potential to prevent falls in daily life. With an aim to translate this practice to other settings, we undertook a Canadian-wide survey to understand current practices. Results of our survey suggest that RBT is used frequently in clinical practice (used by >75% of respondents). Lack of knowledge of RBT is the most significant barrier for those who do not use this method in their practices. Healthcare professionals who were familiar with RBT and open to using it in practice reported barriers related to training, knowledge, human resources, client characteristics, and the practice setting. While low-tech RBT methods are feasible, a question remains as to which perturbations methods are most effective. Our ongoing and future work aims to further develop and evaluate knowledge translation tools to support clinical uptake of RBT in other rehabilitation settings.
S.12i: The challenge of preventing stair falls: Understanding the individual contributions of, and interplay between, environmental and intrinsic factors

Chair: Bradford J. McFadyen
Université Laval, CAN
Location: Sidlaw suite (level 3)

S.12i

The challenges and opportunities of simulating stair falls in a laboratory environment to inform stair handrail design

Alison Novak¹
Toronto Rehabilitation Institute-UHN

Falls can be prevented on a population-level through environmental changes. This is because these extrinsic risk factors are amenable to correction and do not require modifications in individual behaviour or physical function. In the case of stairs, environmental changes can effectively occur through modifications to building codes and standards. However, to affect policy change considerable empirical evidence is needed. When evaluating changes in stair and handrail design parameters there are two aspects of prevention to consider. Firstly, we must understand the effectiveness of the environmental parameter to prevent the unexpected occurrence of a slip, trip, misstep, or other event which may lead to a fall (i.e. to prevent the balance loss from occurring in the first place). In addition to preventing the balance loss from occurring, we must also understand the effectiveness of the environmental parameter to prevent a fall from occurring when an unexpected event occurs and an appropriate balance recovery reaction is required. In general, this component of addressing stair falls has been much more difficult to evaluate in a laboratory environment given concerns with safely simulating stair falls. Adding to this challenge, ~40% of falls on stairs result in backward rotation of the body, while 50% of falls result in forward rotation. These distinct forms of balance loss on stairs place different demands on whole-body control to generate sufficient recovery reactions and should be uniquely simulated in the laboratory environment. To date, several methods to simulate stair falls have been employed in our lab, including support surface removal, support surface rotations, and induced slips. While some of these methods produced the intended type of balance loss, there was significant variability in global recovery responses between participants. In the case of handrail usage specifically, evaluation of size and shape parameters on comprehensive biomechanical measures is a challenge given the lack of repeatability. To address this, a maximum withstood perturbation protocol (MWP) has been implemented, perturbations are delivered via support surface translations demanding participants to reach and grasp for a nearby handrail without stepping. The perturbations increase in magnitude until the participant fails. The MWP permits us to create a repeatable testing protocol where full handrail reliance is required and systematic modifications in design parameters can be assessed. The external validity of this testing paradigm, however, remains unknown. Moving forward, this research will comprehensively evaluate parameters of stair and handrail design to support effective balance recovery reactions, including more detailed analyses of stepping and grasping responses considering age and impairment. Ongoing work is actively being translated to policy makers in CAN and internationally to inform stair and handrail codes and standards.

S.12ii: Stair biomechanics in ageing and diabetic neuropathy: Personal factors underpinning fall risk

Neil Reeves¹
Manchester Metropolitan University

Stair negotiation is one of the most physically challenging activities performed on a daily basis with evidence from studies in both young and older adults measuring joint moments on stairs of standard dimensions. The challenging nature of stair negotiation is particularly evident at the ankle joint where older adults are much slower at arresting downwards CoM velocity compared to young adults. Slower attenuation of the landing impact stems from a reduced ability to generate adequately high eccentric ankle moments at high angular velocities and necessitates using the lowering leg to minimise the loads on the outstretched landing leg. Older adults adopting a sideways stepping strategy (facing sideways, two feet on each step) minimise the elevated joint moment demands at an increased rise height (170mm to 220mm) compared to a typical step-over-step strategy (facing forwards, one foot on each step) and a step-by-step strategy (facing forwards, two feet on each step). Notably, there was minimal increase in ankle joint moment with this sideways stepping strategy and even a slight reduction in the landing limb. Sideways stepping may therefore be considered as a useful strategy to minimise ankle joint moment demands in high fall-risk groups on stairs. The response of the landing limb during stair descent is particularly important in arresting the CoM velocity and ensuring a controlled landing. Whilst ageing reduces ankle strength capacity, diabetic peripheral neuropathy (DPN) not only reduces ankle strength but involves a complete absence of foot sensation affecting knowledge of foot-ground contact. People with DPN pre-activate plantar flexor muscles earlier while the landing limb is being lowered onto the step during descent to compensate for absent sensation. Despite earlier pre-activation, this clinical population shows a much slower rate of ankle joint moment development after contacting the step compared to matched-controls without diabetes and a group with diabetes but no neuropathy. This has implications for limb instability and unsteadiness. Overall, marked impairments to balance control on stairs have been observed in patients with DPN compared to controls and a group with diabetes but no neuropathy. Impaired sensory perception and motor control in the lower limb with DPN are therefore a key factor influencing joint moment development and balance control, placing this clinical group at particularly high risk for falls.

S.12iii: Using visual markings to enhance the visual environment on stairs and reduce stair fall-risk

Richard Foster¹
Liverpool John Moores University

Ambiguous visual properties of stair surfaces are important contributing factors to risky behaviour which can lead to stair falls. Age-related declining visual function or onset of visual impairment contribute to older adults being more susceptible to stair falls. Additional environmental visual factors that contribute to stair negotiation being so challenging include low lighting levels, patterned surfaces and surfaces that are uniform in colour (e.g. Fig. 1A). Locating a stair edge may therefore be easier with the presence of visually contrasting strips (edge highlighters), placed across the stair tread to clearly delinate the edge from the rest of the tread. However, incorrect positioning of edge highlighters on stair treads can also be dangerous. Our previous work has shown that when misleading edge highlighters are set back from the tread edge (e.g. by up to 30 mm), as commonly seen on public stairwells, foot clearances in young and older adults are significantly closer to the tread-edge. Furthermore, for stairs that are uniform in colour or with misleading edge highlighters, accidental foot contacts increase, especially for those with visual impairment. We suggest that an edge highlighter placed flush with the tread-edge clearly delinates the tread from the step below, enabling adequate and less variable foot clearance. Visual markings be assessed as falling into two categories: visual cues that may also alter visual perception (e.g., by creating shadows on the treads or creating surfaces on carpets in the home or tiled pavements/sidewalks). Our computer-based perception tests were previously developed to assess perceptual responses to various visual cue configurations on stairs in young adults. The visual cues appeared as black and white vertical stripes arranged at varying spatial frequencies on a stair riser with an abutting edge highlighter on the stair tread (Fig. 1B), representing a version of the horizontal-vertical illusion (Fig. 1C). Young adults significantly overestimated (up to 25%) the true height of stair risers (190 mm) compared to a plain riser, and the magnitude of overestimation tended to increase with increasing spatial frequencies. When the striped visual cue was superimposed on to physical steps and stairs, there was a significant increase in foot clearance (approximately 1 cm; 17.5%) for older adults during stair ascent, with no accompanying destabilizing effects on postural stability. This suggests there may be a link between what participants visually perceive and their corresponding stepping action. Ongoing research is focused on determining if there is an explicit perception and action link in older adults in response to the visual cue on stairs, and whether the striped visual cue can be simplified in appearance (reduced spatial frequency) and remain effective. Understanding this could help in determining visual cues suitable to place on home or public stairs to help improve stair safety for older adults.
BACKGROUND AND AIM. Our previous work has shown how cognitive factors such as self-confidence and anxiety can influence where individuals look during adaptive locomotor tasks. For example, when walking on targets and stepping over obstacles anxious older adults tend to look away early from imminent obstacles to look at future hazards which, paradoxically, results in reduced stepping accuracy and increased risk of tripping on the imminent obstacle. Stair walking represents a particularly hazardous locomotor activity which can evoke strong feelings of anxiety and fear of falling in older adults especially when illumination levels are low or stair dimensions are challenging or irregular. Cognitive factors such as anxiety and fear of falling influence where and when individuals look on stairs, especially at low light levels, which has repercussions for their walking safety. For example, older adults tend to look less far ahead (i.e. closer to their feet) during stair descent resulting in altered head posture and associated destabilizing changes to centre of mass behaviour. Adequate illumination is important for stair safety. Lighting has become particularly pertinent since incandescent bulbs were banned in many countries, resulting in households using energy saving compact fluorescent lamp (CFL) bulbs. These can take minutes to reach full brightness, which may leave stairwells poorly lit during initial use. Light emitting diode (LED) bulbs are also energy efficient, but reach full brightness immediately and may offer a better alternative. Our own analysis of light bulb characteristics has clearly demonstrated that “low” and “high” power CFL bulbs only produced illumination of 10 and 20 lux respectively averaged over the time taken to descend the stairs. This compared to 35 and 112 instantaneous lux from the low and high power LED bulbs. In order to determine the extent to which stair walking safety was affected by these varying levels of illumination (together with a very bright 300Lux illumination representing optimal lighting), whole-body 3D cinematics (Vicon motion analysis system) and force platform kinematics (3 Kistler force platforms) were recorded to quantify various biomechanical markers of stepping safety and postural stability. RESULTS. During low illumination conditions both younger and older adults report lower self-confidence in their ability to descend stairs safely (Figure 1A) yet only younger adults appear to compensate by adjusting their walking strategies to increase postural stability e.g. by reducing the variability in their trunk vertical acceleration during weight transfer from one step to another (Figure 1B). CONCLUSIONS. The implication of these results, together with those from ongoing analyses of biomechanics and gaze behaviour, for falls risk assessment, individualised falls prevention interventions and built environment design will be discussed.

SYMPOSIA ABSTRACTS

S.12iv

Studying the interplay between cognitive factors and stairwell illumination to better understand falls risk during stair descent

Mark Hollands¹, Neil Thomas¹

Liverpool John Moores University

S.13i

Development of spinal locomotor output

Yury Ivanenko¹

IRCCS Fondazione Santa Lucia

INTRODUCTION. In this presentation, various findings, ideas and approaches will be considered that represent important conceptual frameworks for characterizing and understanding human locomotor development, with a particular emphasis on the first years of life. The spinal cord does not simply transmit information to and from the brain and its maturation and physiologic state determines reflex, postural and locomotor control. We will discuss recent advances in understanding how motor commands are expressed at different stages of human development. METHODS. The spinal locomotor output can be assessed by identifying the basic patterns of lumbosacral motoneuron activity from multimuscle recordings. The idea that the CNS may control complex interactions by modular decomposition has received considerable attention. Each human lower limb contains over 50 muscles, comprising many intrinsic foot muscles, that are coordinated during locomotion. It has been argued that the nervous system may control numerous muscles through modularity, using neural patterns to activate muscles in groups. We explored this idea for human locomotion by examining the spinal locomotor output during early development along with maturation of coordinated patterns of limb motion. RESULTS. The development of human locomotion from the neonate to the adult starts from a rostrocaudal excitability gradient in the spinal motor output and involves a progressive reduction of EMG burst durations and a functional reorganization of the pattern generation circuitry with increasing age. Furthermore, the accomplishment of mature locomotor movements relies upon the integrated coordination of the lower and upper limbs and the trunk, as well as integration of proper load-related proprioceptive feedback. Foot placement patterns in human neonates and the episodes of alternating arm-leg oscillations suggest the potential contribution of load-related proprioceptive feedback and/or the expression of variations in the locomotor program already during early manifestations of stepping on ground in human babies. We will also present data on how early injuries to developing motor regions of the brain in children with cerebral palsy substantially affect maturation of the spinal locomotor output and consequently the future locomotor behavior. CONCLUSIONS. The complexity and flexibility of the spinal locomotor output changes with age. We discuss the precursor of the mature locomotor pattern in infants also in comparison with other animals.

S.13i

What does newborn skateboarding tell us about the ontogeny of human locomotion?

Marianne Barbu-Roth¹, David Anderson², Vincent Forma¹, Joëlle Provaz¹

Paris Descartes University-CNRS, ²San Francisco State University, ³Ecole Pratique des Hautes Etudes

BACKGROUND AND AIM. The acquisition of bipedal locomotion is a celebrated milestone in infant development. However, most human infants start to crawl long before they walk and even without practice, adults retain remarkable crawling capacities. This common observation raises important questions about the connection between bipedal and quadrupedal locomotion and the development of both forms of locomotion during early infancy. Even adult upright bipedal locomotion is not free of quadrupedal mechanisms, with the arms mirroring the motions of the legs, but perhaps more surprising and puzzling are recent reports of a functional quadrupedal organization of the spinal networks underlying walking. When and how does this quadrupedal organization emerge during infant development? Extensive studies of upright bipedal stepping in the newborn have created the impression that humans are born bipeds. In our current study, we challenge this notion by showing that 2-day-old newborns are functional quadrupeds. METHOD. The existence of this independent quadrupedal locomotion was revealed by using a mini skateboard that supported the newborn’s head and trunk and freed the arms to move. We tested 60 at-term typical newborns in two one-minute randomly-ordered conditions: (i) crawling in a prone position on a Mattress (Mattress condition) and (ii) crawling on the mattress with the mini skateboard (Crawli condition). The number and characteristics of the infant’s leg and arm locomotor movements were captured using synchronized video and infra-red motion capture cameras. RESULTS. In the Crawli condition, the analyses of the number and types of limb movements and their characteristics, the coordination of limb pairs, and the displacement across the surface, revealed that newborns are able to use arms and legs to crawl with locomotor patterns similar to those documented during quadrupedal locomotion in animals and human adults. In the Mattress condition, newborns were not able to move across the arms and propel themselves, as they were impeded by the weight of their head and trunk. CONCLUSIONS. This discovery questions the well-established bias toward studying newborns as bipeds and lends credence to the idea that all forms of locomotion, including bipedal gait, could be organized quadrupedally in humans and represented biologically in spinal neuroromotor networks from birth. We propose that humans are born as quadrupeds and develop bipedal competencies later, in concert with maturationally- and experience-driven anatomical changes and practice locomoting in a variety of different contexts. This proposition has very important, though yet to be experimentally verified, implications for the design of interventions for infants at risk for locomotor delays. It suggests these interventions may be more efficacious at hastening the onset of independent walking if they promote quadrupedal locomotion in the early months of life.
INTRODUCTION: Visual proprioception is the sense of self-motion produced by patterns of optic flow. Prior research has shown a dramatic shift in infants’ responsiveness to peripheral lamellar optic flow (PLOF) following the onset of hands-and-knees crawling and, later, during the transition from pre-crawling to belly crawling. This paper examines these behaviors in the context of sellers that place new demands on balance control. It is also possible that the onset of crawling alters visual proprioception because walking demands a different type of balance control than crawling. We tested these predictions in three experiments.

METHOD: Experiment 1 involved comparisons among 64 8-month-old infants categorized as pre-crawlers (n = 25), belly-crawlers (n = 15), and hands-and-knees crawlers (n = 24). Experiment 2 examined 7 infants with spina bifida across the transition to independent belly crawling. Experiment 3 examined 77 11.5-13.5-month-old infants who were categorized as: 1) proficient crawlers (n = 31), 2) less proficient walkers (n = 22), and 3) proficient walkers (n = 24). All infants were tested for responsiveness to PLOF from side-wall motion in a moving room. RESULTS: Experiment 1 revealed that hands-and-knees crawlers were significantly more responsive to PLOF than pre-crawlers (p = .04) and marginally more responsive than belly-crawlers (p = .06), whereas pre-crawlers and belly-crawlers did not differ from each other. Omnibus ANOVA: F (2, 61) = 3.93, p < .05. A Wilcoxon signed-ranks test on the spina bifida infants from Experiment 2 revealed no significant changes in responsiveness to the transition from pre-crawling to belly crawling, Z = -.34, p = .81. The Experiment 3 results showed that the less proficient walkers were more responsive to PLOF than the proficient crawlers (p = .04) but not the more proficient walkers (p = .23). Omnibus ANOVA: F (2, 75) = 3.10, p < .05. DISCUSSION: These findings support the idea that the balance demands associated with new forms of locomotion drive important changes in visual proprioception. The acquisition of skills that place new demands on balance control appears to heighten responsiveness to visual input and facilitate the differentiation of information contained in patterns of optic flow and the subsequent mapping of this information onto motor control strategies.

S.13iv

The internal body representation in a developing brain

Christine Assiaante¹

CNS

BACKGROUND AND AIM: In order to perceive and act in its environment, the individual’s body and its interactions with the environment are represented in the brain. The precise knowledge about how our body is involved in action allows us to act or to interact with our social and non-social environment. At the cerebral level, this knowledge is stored in an internal representation labelled the body schema (BS). The BS is built through ontogeny and is constantly updated using sensory information. Nevertheless, proprioception that encompasses the perception of positional changes and movements of body parts appears to be the most essential sensory modality to build and to update the BS. BS must be updated during development due to many factors such as morphological changes, acquisition of motor skills, and cognitive practice (Assiaante et al, 2014). METHODS: Using a neurosensory approach, the aim of our studies was to highlight the building of the BS through childhood (7-12 years old) and adolescence (13-17 years old) by exploring through proprioceptive integration the maturation of its cerebral basis and its link with behavioural improvement during development. To this end, brain imaging and behavioural performance requiring proprioceptive information were associated to explore the different processes (i.e. perception-action coupling, sensory integration) leading to the elaboration and to the update of an internal body representation in a developing brain. RESULTS: Our results reveal that the neural basis subsuming the BS was already well established as early as the age of 7, although still immature in some aspects. This included a lower level of posterior parietal regions activation, and the exclusive activation of the frontopolar cortex in children compared to adults (Fontan et al, 2017). We also found that proprioceptive network is still undergoing refinement during adolescence, including a shift from diffuse to focal Functional Connectivity (FC) and a decreased FC strength. This developmental process was particularly pronounced for frontostral connections. Furthermore, changes in FC features appeared beyond adolescence, although to a much lower extent. (Cignetti et al, 2016) CONCLUSION: Altogether, these findings support the slow maturation of the proprioceptive network and a protracted developmental time course for the BS network, which breaks with the relatively early functional maturation often associated with sensorymotor networks. References: Assiaante, C., Barlaam, C., Fignetti, C., Vaugouyeau M. (2014). Building of body schema during childhood and adolescence: a neurosensory approach. Neurophysiologie Clinique / Clinical Neurophysiology, (2014) Cignetti, F., Fontan, A., Menant, J., Nazzarian, B., Roth, M., Anton, J.L., Vaugouyeau, M., Assiaante, C. (2016). Early adolescence at a main time window of plasticity in organization of the proprioceptive brain network. Cerebral Cortex, 27: 1285-1296.

S.14i

An interdisciplinary approach to assess the electrophysiological, kinematic and gaze factors related to gait and fall risk in older adults

Chesney Craig¹, Paul Holmes¹, John-Stuart Brittain², Will Young³, Zoe Franklin¹, Nicola Ray¹

¹Manchester Metropolitan University, ²University of Birmingham, ³Brunel University London

PURPOSE AND BACKGROUND: Early identification of individuals at high risk of falls is essential to ensure efficient fall prevention interventions. Given the heterogeneity of fall accidents that are experienced by some older adults, it is important to utilize a multifactorial approach to assess fall risk. Although multifactorial approaches have successfully identified a number of functional and behavioral outcome measures that can predict subsequent falls, less is known about how the neural profile associated with fall risk. The advent of mobile electroencephalography (EEG) technology and advanced signal processing algorithms have enabled remote online measurement of neural activity during active gait, which may provide unique insights into the neural control of asymptomatic and clinically-impaired gait. The field is, however, still in its infancy, and we are unaware of any publication to date that has used mobile EEG in a clinical population during natural gait. This talk will outline how we have employed an interdisciplinary approach to provide a comprehensive characterization of the neural, kinematic, muscular, gaze and psychological factors that may discriminate fallers from non-fallers during naturalistic, gait-adapted and obstacle avoidance. METHODS: We present a novel experimental method that combines mobile 64-channel EEG, wireless electromyography (EMG), motion tracking and mobile eye-tracking, to assess naturalistic gait and obstacle avoidance in older people. We tested 15 participants (N = 20; Mage = 73.32 ± 5.58) and identified fall risk (N = 20; Mage = 73.32 ± 4.55), compared to young adults (N = 20; Mage = 77.75 ± 4.96). These variables were assessed simultaneously during a 2-minute looped walk, followed by a walking and turning cue task, which assessed adaptive gait and obstacle avoidance. Participants walked either straight towards the end of a 6.5m walkway or turned right or left at an intersection depending on a visible cue presented during the walk. During half of the walking trials, an obstacle was present in one of the pathways. Independent Component Analysis was used to remove movement-related artifact from the EEG signals. Ongoing data analysis (at the time of writing) will analyze group differences in gait variables, lower-limb muscle activity, task-relevant gaze fixations and EEG & band oscillations during each gait condition. DISCUSSION: This complex multi-modality experimental protocol considered interactions between related disciplines for a more valid study design, analysis, interpretation and implementation. The interdisciplinary approach, its implementation and current results highlight important implications for assessing fall risk in older adults. In addition, we will outline how the strengths and limitations of our experimental approach provide insights for future research. Recommendations based on this study are currently being implemented in a similar protocol investigating fall risk in Parkinson’s Disease.
Sensorimotor, neuropsychological and daily-life gait assessments to identify people at high risk for falls
Kim van Schooten¹
Neuroscience Research Australia/University of New South Wales

PURPOSE AND BACKGROUND: Falls are a multifactorial problem with causes amongst sensorimotor, cognitive and affective domains. Whilst there is a range of tools for assessing fall risk, few encompass all these domains. Moreover, recent studies suggest that not only one’s balance abilities but also their activity behaviour affect the probability of experiencing a fall. This presentation will address the utility of clinical tests and daily-life gait to identify people at high risk for falls. It will draw upon multidisciplinary studies to discuss the strengths and weaknesses of these approaches and presents results of an interdisciplinary study combining these techniques to assess fall risk.

METHODS: The first part of the presentation will consider recent observations on multifactorial risk factors for falls in general and clinical ageing populations. We pooled data of 1,230 participants (74±10yrs; 640G, including 500 community-dwelling older people and four clinical groups with balance disorders (Parkinson’s disease, N=312; dementia, N=175; stroke survivors, N=140; multiple sclerosis, N=111), to characterise similarity in risk factors for falls. Our results confirm that deficits in cognition (executive function) and affect (depressive symptoms, concern about falling) are at least equally important as sensorimotor function in fall-risk prediction and should therefore be included in routine clinical assessment. The second part of the presentation will review current evidence for using daily-life gait characteristics to identify people at risk for falls. This part will touch upon dependency on activity recognition, estimation of characteristics, models used to predict risk and fall-risk definitions. Recent work on the predictive ability for falls of daily-life gait characteristics combined with clinical tests of sensorimotor, cognitive and affective function in older people will be presented and compared to previous work.

DISCUSSION: Taken together, the studies will provide an overview of interdisciplinary approaches, combining sensorimotor, neuropsychological and daily-life gait assessments, to assess fall risk in various populations. Transdisciplinary collaboration is needed to implement these assessments into clinical practice.

Addressing misconceptions relating to fear of falling and the control of adaptive gait
William Young¹
Brunel University London

BACKGROUND AND AIM: The problem of how to predict and prevent falls is a major concern for governments and health services dealing with the wide-ranging economic and social consequences of falls and related injuries. Over recent decades much research has been carried out to identify physical, social and environmental risk-factors for falls. Factors within each of these categories can serve as strong predictors of fall-risk, particularly concerning measures of functional balance. However, some researchers argue that too much emphasis is placed on simple clinical outcome measures, in part, because such tests are generally considered to encompass physiological status along with numerous trait and state factors relating to individual differences in disposition etc. This being the case, such assessments are not sensitive to certain specific dispositions and associated behaviours that might have an independent role in influencing balance in specific tasks/contexts. Being fearful of falling is an example of such a disposition. Much research has demonstrated the impact that fear of falling (or concern about one’s balance ability) can have on functional outcomes associated with fall-risk. However, researchers have only recently started to evaluate how fear of falling (and related state anxiety) can influence attentional processes/biases and associated prioritisation strategies during movement planning and execution.

METHODS: This presentation will cover examples of potential misinterpretations evident in the literature, relating specifically to how fear of falling influences the control of balance and adaptive gait. In particular, the talk will focus on mechanisms suggested to underpin conservative movement strategies observed in fearful older adults (including increased muscle co-contractions and reduced visual search behaviour). Examples will be given from my own laboratory where we applied extant anxiety-related psychological theories (e.g., Reinforcement and Attentional Control Theory) to the context of ageing and falls, only to establish through incremental studies that the perspectives set out by such theories do not always readily translate and, in some cases, can lead to misconceptions that cause fundamental problems with our capacity to interpret findings. The objective of this presentation is, therefore, to promote discussion about how we can be vigilant to potential misconceptions so that we might best-inform the selection of specific outcome measures used in future research.

CONCLUSIONS: The presentation will conclude with a summary of what ‘we think we know now’ in the context of anxiety-related changes in attention during gait, along with recommendations for how current knowledge can be utilised by future cross-sectional and prospective studies evaluating fall-risk in older adults.

Automatic recognition of gait patterns with machine learning
Yuhan Zhou¹, Tibor Hortobágyi¹, Claudine Lamoth¹
University Medical Center Groningen

PURPOSE AND BACKGROUND: Physical, emotional, cognitive, behavioral and social factors and their interactions underlie gait and balance abilities and fall risk in older adults. The International Classification of Functioning, Disability and Health (ICF) model can be used as a framework to examine the multifactorial nature of gait and balance decline and fall risk. For machine learning to contribute significantly and meaningfully to the understanding and prevention of fall risk and the estimation of movement related disorders, the collaboration between different disciplines (clinicians, physiotherapists, data scientists) is necessary. Here, we present a model using an aggregate analysis of gait accelerometer data from healthy adults and geriatric patients. The first purpose of this study was to identify the most accurate machine learning method to automatically classify gait patterns in groups of participants; the final purpose of the model is to early identify at-risk gait and evaluate treatment outcomes.

METHODS: Healthy young and middle-aged adults (n=58, age: 42.7±16.60), healthy old adults (n=54, age: 74.6±5.71), and geriatric patients without cognitive impairment (n=126, age: 79.3±5.81) participated in this study. Trunk accelerations were measured with 3D accelerometers (Dynavert® MiniMod, Mobi outdoors BV & iPod touch 4G, iOS 6, Apple Inc.; sample frequency±100 Hz) during three minutes of walking. From the 3D accelerometer signals, we extracted 23 gait-related variables quantifying gait pace, stability, regularity, variability. A Kernel Principal Component Analysis (KPCA) was applied to extract underling gait features and reduce the dimensionality of the data for Support Vector Machine (SVM) classification, compared other machine learning methods Random Forest (RF) and Artificial Neural Network (ANN) with raw features. These methods also can be extended for other kinds of variables to predict different labels, such as fall risk and Parkinson’s disease.

RESULTS: KPCA reduced gait data dimensions efficiently from 23 dimensions to five dimensions, explaining 97% of the variance, and representing gait features of pace, synchronization, regularity, and variability. Preliminary analyses showed that both SVM (accuracy=89%, AUC=0.91) and ANN (accuracy=90%, AUC=0.87) could differentiate gait patterns between the three age-based groups. RF was sensitive to parameter selection and results in worse classification performance (accuracy=73% and AUC=0.48).

CONCLUSIONS: Aging affects specific gait features that can be identified by non-linear approaches such as KPCA followed by SVM or ANN classifiers. Both of these classifier methods reveal differences in temporal gait characteristics between age groups. Future analyses will add data on person’s objective and subjective measures at the different levels of the ICF model. In addition, different machine learning models will be added to investigate labelled disorders, to finally predict the risk of falling.
Chair: Brett Fling  
Colorado State University, USA

**BACKGROUND AND AIM**

Previous works documents that surround inhibition and intra-/interhemispheric inhibition in the somatosensory and motor systems are mediated by gamma-aminobutyric acid (GABA). Surround inhibition describes cortical lateral inhibition of surrounding receptive fields upon skin contact or muscle activity, resulting in a sharper neural representation of stimuli. Surround inhibition has also been shown to extend to contralateral homologous representations and to the motor system. The effects of healthy aging on these inhibitory functions and their underlying mechanisms are neither well characterized nor understood. Thus, in the current study we determined tactile thresholds for a given finger while either a neighboring or the contralateral digit were simultaneously stimulated; this allowed us to test tactile surround inhibition in individuals across a wide range of ages. We also used bimanual motor tasks to assess motor intra- and inter-hemispheric inhibition to illustrate the trajectory of decline and to test for associations between age differences in the two systems. METHODS: Participants ranging from 18 to 76 years old performed assessments of tactile and motor inhibitory function. To evaluate tactile surround inhibition, we determined tactile thresholds for a given finger while either a neighboring or the contralateral digit were simultaneously stimulated. Typically, this results in higher (i.e., less sensitive) tactile thresholds, due to surround inhibition. Since inhibitory function declines with age, however, we predicted that low amplitude stimulation on a neighboring finger would decrease tactile thresholds for older adults due to “spillover” effects. Participants also performed motor tapping tasks requiring asynchronous movements of two neighboring digits or of two homologous digits (i.e. bimanual actions), which we have previously linked to inhibitory function. RESULTS: Older age was associated with greater decreases in tactile detection threshold when a stimulus was simultaneously applied to a neighboring or the contralateral homologous finger. These findings are indicative of age-related declines in surround inhibition. Additionally, increasing age was significantly associated with poorer performance on the motor task requiring asynchronous actions of neighboring fingers on the same hand, again supporting reduced intra-hemispheric inhibition with age. Declines in inhibitory function were evident starting in the fifth decade of life, but were not correlated between tactile and motor systems. CONCLUSIONS: Our findings demonstrate that aging impacts tactile and motor inhibitory function, particularly for behaviors that are mediated by GABA neurotransmission. In ongoing work we are evaluating whether similar age declines in inhibitory function are evident for the lower limbs, are associated with magnetic resonance spectroscopy measures of GABA, and are associated with age declines in gait performance. NIH 1R56AG043402.

---

**S.15i**

Age-related changes in sensorimotor inhibition and the associated implications for impaired gait and balance control

**S.15i:** STOP! Age-related changes in sensorimotor inhibition and the associated implications for impaired gait and balance control

**Chair:** Brett Fling  
**Colorado State University, USA**

**Location:** Pentland suite (level 3)

**S.15ii**

The effects of age and task difficulty on the neural control of standing balance

**Tibor Hortobagyi,**  
Univiersity Medical Center Groningen, University of Groningen, **MOTEX**

**BACKGROUND AND AIM:** We examined the hypothesis that when quiescent standing is challenged by reductions in base of support, sensory perturbations, or old age, motor cortical (M1) supervision of standing balance becomes necessary with a putative role assigned to the GABAergic inhibitory system. METHODS: We collected transcranial magnetic stimulation data while healthy adults stood in a wide, narrow, tandem, and one-legged stance and healthy young and old adults stood with and without support at the chest, stood on a rigid and foam surface with eyes open or closed, and sat or leaned forward with and without a support at the chest. We also examined the effects of a simulated balance task on dual-task costs while lying in an MRI scanner. RESULTS: While the net corticospinal input to biomechanically relevant leg muscles increases with reductions in base of support in the mediolateral direction and GABAergic inhibition decreases, these outcomes do not correlate with sway magnitude (1,2). Likewise, M1’s involvement became more prominent in free vs. supported standing (3). There also was disinhibition of M1 in standing independent of age but an age-specific reduction in GABAergic intracortical inhibition that correlated with center of pressure proprioceptive perturbation (4). When healthy young and old adults sat and voluntarily leaned forward with and without a chest support, the area of EMG suppression produced by brain stimulation, i.e. GABAergic intracortical inhibition, was ~60% smaller in unsupported vs. supported leaning and sitting, with no difference between these latter two conditions (5). Leaning closer to the maximum without support correlated with less M1 inhibition. While age did not affect the motor control strategy as quantified by the modulation of M1 activity, the modulation appeared at a lower task difficulty with increasing age. The critical factor in modulating M1 activity is postural challenge instead of contraction aim (voluntary, postural) or posture. When standing difficulty was simulated in an MRI scanner by keeping a forward or backward falling avatar vertical by plantarflexing toward a load cell in combination with a calculation task, the age-related increase in brain activation and dual-task costs did not correlate, suggesting that the dual-task costs were not due to increased structural interference (6). CONCLUSION: When quiet standing is challenged by reductions in base of support, sensory perturbations, or old age, motor cortical supervision of standing balance becomes evident. Future experiments will clarify if age- and task-differences in M1 activation underlie impaired postural control and postural instability. 1. Nandi GP 60:135-140, 2018. 2. Nandi FHN12:303, 2018. 3. Papegaaij EJAP 116:959-967, 2016. 4. Papegaaij FAN FAN 6:28, 2014. 5. Papegaaij EG 73:85-86, 2015. 6. Papegaaij PONE 12(12):e0189025, 2017.

**S.15iii**

Effects of age and mental fatigue on dynamic postural control

**Anita Christie,**  
The University of Western Ontario, **The University of Oregon**

**BACKGROUND AND AIM:** A psychophysiological state that occurs after or during prolonged periods of cognitive activity. Older adults report higher levels of fatigue than young adults, which is associated with impaired motor performance. Despite these important associations, little is known about the direct impact of mental fatigue on physical function. The reduction in attentional resources that occurs with mental fatigue may exacerbate compromises in balance control in older adults. The aim of this work is to examine the impact of mental fatigue on postural control in older adults and to identify neural contributions to reduced function. METHODS: We examined the impact of mental fatigue on responses to postural perturbations in young and older adults. Participants stood on two force platforms that were anteriorly translated at random intervals before, during and following a mentally-fatiguing task. Postural responses to the perturbations and assessments of neuromuscular properties, including transcranial magnetic stimulation measures of corticospinal excitability and intracortical inhibition were assessed before, during and after the mentally-fatiguing task. In a sub-group of young individuals with reported high levels of mental fatigue and measured impairments in gait balance control, magnetic resonance spectroscopy was used to assess concentrations of glutamate and gamma-aminobutyric acid (GABA) in the primary motor cortex (M1) and the dorsolateral prefrontal cortex (DLPFC). RESULTS: Older adults had slower reaction times and greater postural responses to perturbations than young. Mental fatigue did not differentially affect the magnitude of the postural responses in young and older adults. However, the velocity of the postural responses to perturbations was slower in older adults compared with young, during conditions of mental fatigue. Older adults had a greater reduction in overall muscle activity during the postural response following mental fatigue than young. Relative to young, older adults showed a similar change in motor cortical excitability in response to mental fatigue, but a greater change in intracortical inhibition. In a population of individuals who report high levels of mental fatigue, and demonstrate impaired dynamic balance control, we have shown a lower glutamate/GABA ratio in M1, but a higher Glutamate/GABA ratio in the DLPFC. CONCLUSION: The condition of mental fatigue may impact some aspects of dynamic balance control, particularly in older adults. Concurrent changes in muscle activation and intracortical inhibition suggest central factors involving inhibition are likely involved in the observed alterations in postural control. The region-specific implicances in neurotransmitters in a sub-group of young individuals may help to inform observed changes with mental fatigue in older adults.
Age-related differences in associations between dynamic gait characteristics and motor cortex inhibition

Brett Fling¹, Clayton Swanson¹
¹Colorado State University

BACKGROUND AND AIM: Healthy aging is associated with structural and functional alterations in the brain and declines in multiple facets of motor performance including gait, balance, and motor coordination. For example, interlimb coordination and performance during turning both diminish with age, posing a risk for gait-related injuries. Cortical inhibitory processes are essential for optimal motor control and undergo age-related alterations that may account, at least in part, for these behavioral deficits. In this regard, a key role is played by gamma-aminobutyric acid (GABA), the principal inhibitory neurotransmitter within the nervous system. Recent studies demonstrate that levels of motor inhibition are related to GABAergic function and that levels of GABA diminish with advancing age. In fact, levels of inhibition within the motor cortex are significantly associated with coordination of the upper extremities, however, it is unknown if this same association exists for dynamic lower extremity control required for daily tasks such as coordinating the legs while walking and turning.

METHODS: Our results are from a current sample of nearly 50 healthy adults, comprised of younger (18-30 years old) and older adults (65-80 years old). Cortical inhibition is assessed via the cortical and ipsilateral silent period within the dominant and non-dominant cortical hemisphere, both of which are elicited by TMS within muscles of the lower extremities. Dynamic measures of gait, including the phase coordination index and multiple measures of turning performance, are collected and analyzed through the use of six, wireless inertial sensors during 2- or 6-minute over-ground walking trials at a self-selected pace.

RESULTS: We report that older adults demonstrate significantly reduced performance during turning coupled with reduced coordination and increased variability during over-ground walking, compared to a younger cohort. In addition, we report reduced cortical inhibition within the non-dominant (right) motor cortex of these older adults. Interestingly, measures of gait coordination and variability demonstrated a positive relationship with cortical inhibition in the younger adults, while there was a negative correlation between inhibition and these same behavioral measures in older adults. Furthermore, motor cortex inhibition was significantly associated with multiple turning characteristics.

CONCLUSIONS: Taken together, these results propose a fundamental difference in the relationship between motor cortex inhibition and lower extremity control with age; younger adults are better able to maintain lower extremity coordination and variability with reduced cortical inhibition, whereas older adults with increased cortical inhibition demonstrate better mobility performance. Importantly, these findings are complimentary to previous work demonstrating age-related differences in the association between motor cortex inhibition with bimanual control.
<table>
<thead>
<tr>
<th>NAME</th>
<th>POSTER NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russo-Junior,</td>
<td>P1-N-115, P2-Q-150, P3-Q-143</td>
</tr>
</tbody>
</table>
**AUTHORS AND PRESENTERS INDEX**

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSTER NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zult, Tjerk P</td>
<td>P1-G-119</td>
</tr>
<tr>
<td>Zukowski, Lisa A</td>
<td>P2-G-48</td>
</tr>
<tr>
<td>Zisberg, Anna</td>
<td>P2-C-105</td>
</tr>
<tr>
<td>Zijdewind, Inge</td>
<td>P2-C-20</td>
</tr>
<tr>
<td>Zia Ur Rehman, Rana</td>
<td>P1-Q-150</td>
</tr>
<tr>
<td>Zhuk, Daria</td>
<td>P2-H-72</td>
</tr>
<tr>
<td>Zhou, Yuhan S.</td>
<td>S14.iv</td>
</tr>
<tr>
<td>Zhou, Zhi</td>
<td>O.1.i</td>
</tr>
<tr>
<td>Zhou, Junhong</td>
<td>P1-G-52, P1-O-121, Zheng, Yong-Ping</td>
</tr>
<tr>
<td>Zhao, Manfei</td>
<td>P1-I-78</td>
</tr>
<tr>
<td>Zhang, Wei</td>
<td>P1-M-101</td>
</tr>
<tr>
<td>Zeilig, Gabriel S.</td>
<td>S.1ii, O.4.ii, P2-N-107</td>
</tr>
<tr>
<td>Zandvoort, Coen O.</td>
<td>O.5.i, P3-E-39</td>
</tr>
<tr>
<td>Zagatto, Alessandro M</td>
<td>P2-V-157</td>
</tr>
<tr>
<td>Zabetian, Cyrus</td>
<td>P O.1.iii</td>
</tr>
<tr>
<td>Zaback, Martin S.</td>
<td>S.7ii, P1-B-11, P2-G-45</td>
</tr>
<tr>
<td>Yu, Yawen</td>
<td>P2-X-190</td>
</tr>
<tr>
<td>Yu, Wanting</td>
<td>P1-W-180</td>
</tr>
<tr>
<td>Youssim, Iaroslav O.</td>
<td>O.2.iii</td>
</tr>
<tr>
<td>Young, William S.</td>
<td>S.14i, S.14.iii, P1-G-49</td>
</tr>
<tr>
<td>Yoo, Angela (Jaeeun)</td>
<td>P1-H-67, P1-K-90</td>
</tr>
<tr>
<td>Yonemoto, Ryuma O.</td>
<td>O.2.i</td>
</tr>
<tr>
<td>Yeh, Li-Yun</td>
<td>P2-M-101</td>
</tr>
<tr>
<td>Yasuda, Kazuhiro</td>
<td>P1-H-66, P3-K-92</td>
</tr>
<tr>
<td>Yarnall, Alison J</td>
<td>P1-E-40, P1-Q-152, P1-Y-190</td>
</tr>
<tr>
<td>Yang, Chieh-ling</td>
<td>P2-E-33</td>
</tr>
<tr>
<td>Yang, Shuo</td>
<td>P3-Q-149</td>
</tr>
<tr>
<td>Yamazaki, Masashi</td>
<td>P1-K-91, P1-O-125, Yamamoto, Yasutada</td>
</tr>
<tr>
<td>Yamamoto, Masahiko</td>
<td>P1-X-189, P3-W-183</td>
</tr>
<tr>
<td>Yamagiwa, Hideo</td>
<td>P1-H-66</td>
</tr>
<tr>
<td>Yamada, Masahiro</td>
<td>P2-G-51, P2-N-113, Yamada, Masa</td>
</tr>
<tr>
<td>Yamada, Hiroki</td>
<td>P3-D-25</td>
</tr>
<tr>
<td>Yalla, Sai</td>
<td>P1-M-102</td>
</tr>
<tr>
<td>Yaldizli, Oezguer</td>
<td>P1-K-88</td>
</tr>
<tr>
<td>Yalcinkaya, Gamze</td>
<td>P3-S-155</td>
</tr>
<tr>
<td>NAME POSTER NUMBER</td>
<td></td>
</tr>
<tr>
<td>NAME POSTER NUMBER</td>
<td></td>
</tr>
<tr>
<td>NAME POSTER NUMBER</td>
<td></td>
</tr>
<tr>
<td>NAME POSTER NUMBER</td>
<td></td>
</tr>
<tr>
<td>NAME POSTER NUMBER</td>
<td></td>
</tr>
<tr>
<td>NAME POSTER NUMBER</td>
<td></td>
</tr>
<tr>
<td>NAME POSTER NUMBER</td>
<td></td>
</tr>
<tr>
<td>NAME POSTER NUMBER</td>
<td></td>
</tr>
<tr>
<td>NAME POSTER NUMBER</td>
<td></td>
</tr>
<tr>
<td>NAME POSTER NUMBER</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES**

- Queen's University Belfast
- Mihalis Doumas¹, Laura Coulter¹
- University of Groningen, University Medical Center Groningen, University Grenoble-Alpes

**POSTER SESSION INFO**

**POSTER SESSION 1: MONDAY 1 JULY**

**A - Activity monitoring**

**P1-A-1** Monitoring walking activity with wearable technology in rural-dwelling older adults in Tanzania: A feasibility study nested within a frailty prevalence study

**Presenters:** Silvia Del Din, Emma Grace Lewis², William Gray², Harry Collin¹, John Kissima², Lynn Rochester³, Catherine Dotchin³, Sarah Urasa, Richard Walker²

¹Newcastle University, ²Northumbria Healthcare NHS Foundation Trust, North Tyneside General Hospital, ³Ysa District Hospital, ⁴Institute of Neuroscience, Newcastle University, ⁵Kilimanjaro Christian Medical Centre

**P1-A-2** The impact of freezing of gait in daily life: A wearable sensors approach

**Presenter:** Martina Mancini

Marta Mancini¹, Vrutangkumar Shah¹, Carolin Curtze², Samuel Stuart¹, Mahmoud El-Gohary³, James Curtze², Samuel Stuart¹, Mahmoud El-Gohary³, James Curtze², Silvia Del Din

¹Oregon Health & Science University, ²University of Nebraska Omaha, ³APDM, ⁴Portland State University

**B - Adaptation, learning, plasticity and compensation**

**P1-B-3** Targeted familiarization based on user feedback and motor control principles to optimize positive adaptation strategies for learning to walk with a passive load-bearing exoskeleton: A feasibility study

**Presenter:** Laurent Bouyer

Laurent Bouyer¹, Krista Best², Thomas Karakolis³, Gabriell Diamond-Ouellette¹, Etienne Lamoureux⁴, Kurt Modie⁵

¹Univeristé Laval, ²CIRRIS-Universite Laval, ³Defence Research and Development Canada, ⁴Mawashi Science & Technology, ⁵Defence Science and Technology Australia

**P1-B-4** The moving platform illusion in older adults: Effects of the duration of adaptation to a sway-referenced environment on perceptual delays and postural aftereffects

**Presenter:** Mihalis Doumas

Mihalis Doumas¹, Laura Coulter¹

¹Queen's University Belfast

**P1-B-5** Foot speed perception during split-belt treadmill adaptation in adults with Parkinson’s disease

**Presenter:** Dorelle Hinton

Dorelle Hinton¹, Roger Wei¹, David Conradsson⁵, Caroline Paquette⁷

¹McGill University, ²Karolinska Institutet

**P1-B-6** Influence of smartphone use while walking: The relationship between obstacle avoidance and adaptive walking caused by smartphone use

**Presenter:** Sato Ren

Sato Ren¹, Kotaro Shimizu¹, Yukiyo Nishikawa¹, Yuriko Kitahara¹, Kazunari Itou¹, Keita Tai¹, Takero Furuma¹

¹Sapporo Medical University, ²Goryokaku Hospital, ³Japan Health Care College, ⁴Ashikawa Rehabilitation Hospital, ⁵Houseki Motomachi Himawari Clinic

**P1-B-7** Gait adaptations in response to perturbation treadmill training in Parkinson's disease: Time-course, sustainability and transfer

**Presenter:** Simon Steib

Mihalis Doumas¹, Laura Coulter¹

¹University of Groningen, University Medical Center Groningen, University Grenoble-Alpes

**P1-B-8** Task-specific modulation of the soleus H-reflex following a single balance training session

**Presenter:** Craig Tokuno

Craig Tokuno¹, Louis-Solal Giboin², Andreas Kramer², Markus Gruber²

¹Brock University, ²University of Konstanz

**P1-B-9** Large errors upon introduction vs. removal of the training environment have distinct effect on the generalization of locomotor adaptation

**Presenter:** Gelsy Torres-Oviedo

Gelsy Torres-Oviedo¹, Digna de Kam¹, Wouter Staring²

¹University of Pittsburgh, ²Radboud University Medical Center

**P1-B-10** Changes in muscle activation patterns underlie split-belt gait adaptation

**Presenter:** Daniëlle Vervoort

Daniëlle Vervoort¹, Rob den Otter¹, Tom Buurke¹, Nicolas Vuillerme², Tibor Hortobágyi³, Claudia Lamoth¹

¹University of Groningen, University Medical Center Groningen, ²University Grenoble-Alpes
C - Aging
P1-C-12 Two-year change in gait variability in community-living older adults
Presenter: Bård Bogen
Bård Bogen¹, Mona Aasland¹, Anette Ranhorn², Rolf Moe-Nilsen²
¹University of Bergen

P1-C-13 The effects of mechanical and cognitive constraints on beam walking in older adults
Presenter: Andréia Abud da Silva Costa
Andréia Abud da Silva Costa¹, Tibor Hortobágyi², Andrew Sawers³, Renato Moraes⁴
¹Ribeirão Preto School of Medicine - FMRP-USP, ²University of British Columbia,
³Centro Hospitalar do Porto, ⁴Federal University of Paraná

P1-C-14 Low function based on spatio-temporal gait variables and disability
Presenter: Takehiko Doi
Takehiko Doi¹, Sho Nakakubo¹, Kiku Tsutsumimoto¹, Minji Kim¹, Satoshi Kurita¹, Hideaki Ishii¹, Hiroyuki Shimada¹
¹National Center for Geriatrics and Gerontology

P1-C-15 Age-related differences in lower limb joint moments during walking
Presenter: Yuto Fukuda
Yuto Fukuda¹, Takeshi Yamaguchi¹
¹Tokohu University

P1-C-16 "Cognitive and Motor interaction in Older populations (ComOn)" - A prospective multi-center study for quantitative evaluation of treatment effectiveness in 1000 geriatric patients with cognitive and motor deficits
Presenter: Johann Geritz
Johanna Geritz¹, Sara Maetzold², Andrea Pilotto², Marta Corra³, Walker Morosovitch⁴, Maria Rizzetti⁴, Barbara Borroni¹, Alessandro Padovani¹, Annekathrin Alpes¹, Corinna Bang¹, Igor Barcellos⁴, Ralf Baron¹, Thorsten Bartsch¹, Jos Beckstepe¹, Daniela Berg¹, Lu Bergeest¹, Philipp Bergmann¹ Raquel Bouca-Machado¹, Michael Dre¹, Christin Ehlers¹, Morad Elshehab¹, Susan Farahmandi², Andre Franke¹, Anja Friederich¹, Corinna Geisel¹, Janne Gierthmühlen¹, Oliver Granert¹, Sebastian Heineiz¹, Maren Hellen¹, Markus Hobert¹, Marc Hofmann¹Philipp Hulleman¹, Bjorn Jemlich¹, Laura Kerkmann¹, Stephanie Knüfer¹, Katharina Krause¹, Maximilian Kress¹, Sonja Krupp², Jennifer Kudella¹, Gregor Kuhlenbaum¹, Roland Kurth¹, Frank Leyoldt¹, Corina Maetzer¹, Luis Mai¹, Patricia Neumann¹, Katharina Niemann¹, Christian Ortlieb¹, Steffan Paschen¹, Hoang Pham¹, Thomas Puehler¹, Franziska Radloff¹, Christian Riedel¹, Simone Sablowsky¹, Elena Schanz¹, Linda Schebesta¹, Andreas Schicketanzmueller¹, Simone Studt¹, Martina Thaves¹, Sebastian Ullrich¹, Paul Urban¹, Nuno Vila-Cha¹, Elke Warmerdam¹, Tobias Warnecke¹, Michael Weiss¹, Anna Wiegard¹, Clint Hansen¹, Walter Maetzer¹

D - Biomechanics
P1-D-25 The role of limb length and stature in the transition from walking to running
Presenter: Niiamh Gill
Niiamh Gill¹, Kristen Hollands¹, Anmin Liu¹, Dale Walker¹, Andrew Roberts², Thomas O'Leary¹, Julie Greeves², Richard Jones³
¹University of Salford, ²Army Personnel Research Capability

P1-D-26 Virtual reality training affects joint angle strategies which correlate with safer real-world obstacle crossing
Presenter: Chan Lojaco
Chan Lojaco¹, Michael Kress¹, Christopher Rhea²
¹University of North Carolina, Greensboro

P1-D-27 Excessive arm swings and asymmetric walking lead to more variability in the trunk kinematics
Presenter: César Mezher
César Mezher¹, Allen Hill¹, Tarique Siraj¹, Julie Nantel¹
¹University of Ottawa

P1-D-28 Plantar pressures and muscle activity of normal and pes planus foot postures wearing different footwear during treadmill walking
Presenter: Katrīna Protopapas
Katrīna Protopapas¹, Stephen Perry¹
¹Wilfrid Laurier University

P1-D-29 Sagittal balance control during perturbed walking
Presenter: Maud van den Bogaart
Maud van den Bogaart¹, Sjoerd Bruijn², Jaap van Dieën³, Pieter Meyns³
¹University of Salford, ²Army Personnel Research Capability

E - Brain imaging/activation during posture and gait
P1-E-30 Mapping the cortical representation of lower-limb muscles using transcranial magnetic stimulation
Presenter: Jennifer Davies
Jennifer Davies¹
¹Cardiff University
P1-E-31 Reduced weight-shifting skills during single- and dual-task conditions are accompanied by altered neural activation in ageing
Presenter: Veerle de Rond
Veerle de Rond¹, Diego Orcioli-Silva², Lynn Rochester³, Jean-Jacques Orban de Xivry¹, Annette Pantall⁴, Alice Nieuwboer¹
KU Leuven, ¹São Paulo State University (UNESP), ²Institute of Neuroscience, Newcastle University, ³Newcastle University

P1-E-32 Postural state modulation of reactive balance control
Presenter: Mark Taylor
Mark Taylor¹, Paula Polastri³, Jessy Varghese¹, William McIvor¹
University of Waterloo, ¹São Paulo State University (UNESP)

P1-E-33 Functional interplay between body sway and posture-promotor network revealed by somatosensory potentials evoked by foot sole stimulation and microencephalography
Presenter: Laurence Mouchino
Laurence Mouchino¹, Marie Fabre¹, Edith Ribot-Ciscar¹, Rochelle Ackerley¹, Jean-Marc Aimonetti¹, Laurence Mouchnino¹, Marie Fabre¹, Edith Ribot-Microneurography

P1-E-34 An exploratory in vivo voxel-based PET analysis of cholinergic correlates of postural sway variability in Parkinson’s disease
Presenter: Martijn Muller
Martijn Muller¹, Uros Marusici¹, Prabesh Kanel², Nicolaas Bohnen²
¹University of Michigan, ²Science and Research Centre Koper

P1-E-35 Neural correlates of body dynamics
Presenter: Nicholas Murray
Nicholas Murray¹, Gustavo Sandri Heidner¹, Caitlin O’Connell¹, Chris Mizzelle¹, Zac Domire¹
¹East Carolina University

P1-E-36 Evidence for an alternate neural control in freezing of gait during complex walking
Presenter: Caroline Paquette
Trina Mitchell¹, Alexandra Potvin-Desrochers¹, Anne-Louise Lafontaine¹, Oury Monchi², Alexander Thiel¹, Caroline Paquette¹
¹McGill University, ²University of Calgary

P1-E-37 A brainstem, subcortical and cortical network for dynamic balance control in healthy older adults
Presenter: Elizabeth Pasman
Elizabeth Pasman¹, Martin McKeown¹, Saurabh Garg¹, Taylor Cleworth², Bastiaan Bloem³, J Timothy Inglis¹, Mark Carpenter¹
¹University of British Columbia, ²University of Waterloo, ³Radboud University Medical Center

P1-E-38 Functional near-infrared imaging of the temporo-parietal junction during vestibular rotational stimulation
Presenter: Patrick Sparto
Patrick Sparto¹, Theodore Huppert¹, Helmet Karim¹, Joseph Furman¹
¹University of Pittsburgh

P1-E-39 Understanding the hemodynamic response and sensory contribution to automatic postural control
Presenter: Gabrielle St-Amant
Gabrielle St-Amant¹, Tabassum Rahman¹, Nadia Polkaïna¹, Sarah Fraser¹, Yves Lajoie¹
²University of Ottawa

P1-E-40 Structural neural correlates of independent gait characteristics in Parkinson’s disease
Presenter: Joanna Wilson
Joanna Wilson¹, Brook Galna¹, Sue Lord³, Alison Yarnall¹, Rachael Lawson¹, Gordon Duncan⁴, Tien Kho³, David Burn¹, Lynn Rochester¹, John-Paul Taylor¹
¹Newcastle University, ²University of Auckland, ³Auckland University of Technology, ⁴University of Edinburgh, ⁵Griffith University, ⁶Institute of Neuroscience, Newcastle University

F - Cognitive impairments

P1-F-41 Step-length changes caused by a dual-task test among individuals undergoing memory assessment - a pilot study
Presenter: Anna Cristina Åberg
Anna Cristina Åberg¹, Fredrik Timmark¹, Lars Berglund¹, Kjartan Halvorsen¹, Vilamants Giedraitis¹
Uppsala University, ¹The Swedish School of Sport and Health Sciences, GIB

P1-F-42 Comparison in postural sway between healthy control and mild cognitive impaired group with dual tasks
Presenter: Junggil Kim
Junggil Kim¹, Jinsoo Lee¹, Jeongwoo Seo¹, Jinseong Choi¹, Gyerse Tack¹
Konkuk University

P1-F-43 Is gait variability a biomarker of neurodegenerative disorders?
Presenter: Manuel Montero-Odasso
Manuel Montero-Odasso¹, Yanina Sarquis-Adamsen², Natalia Ravid¹, Quincy Almeida³, Frederico Pieruccini-Faria¹, Kerry Howell¹, Richard Camicioli²
¹University of Western Ontario, ²University of Alberta, ³Wilfrid Laurier University

P1-F-44 The association between spatial navigation and physical function in memory clinic patients
Presenter: Gro G. Tangen
Gro Tangen¹, Anne-Brita Knapskog¹, Elisabeth Telenius¹, Geir Selbæk¹, Kristin Taraldsen³
¹Norwegian National Advisory Unit on Ageing and Health, ²Oslo University Hospital, ³Norwegian University of Science and Technology

G - Cognitive, attentional, and emotional influences

P1-G-45 Effects of concussion history on centre of pressure during static dual-tasking in collegiate athletes
Presenter: Kelsey Bryk
Kelsey Bryk¹, Jaclyn Caccese¹, Katherine Hunzinger¹, Thomas Buckley¹
¹University of Delaware

P1-G-46 Does it matter where you look during obstacle crossing?
Presenter: Hye Young Cho
Hye Young Cho¹, Nathaniel Romine¹, Fabio Barbieri¹, Shirley Riedty¹
¹Purdue University, ²São Paulo State University (UNESP)

P1-G-47 The influence of social anxiety on balance and walking task assessment in older women
Presenter: Diego Orcioli-Silva
Diego Orcioli-Silva¹, Elizabeth Pasman¹, Lilian Gobbi¹, Mark Beauchamp³, Mark Carpenter²
¹São Paulo State University (UNESP), ²University of British Columbia

P1-G-48 Lateropulsion is common after right hemisphere stroke, strongly related to spatial neglect, and the primary cause of mobility limitation
Presenter: Dominik Pernennou
Dominik Pernennou¹, Shenhao Dai², Emmauelle Clarac², Andréa Kistner¹, Patrice Davoine³, Anne Chrépin³, Marie Jaeger³, Olivier Detante³, Marc Hommel³, Monica Baciu³, Céline Piscicelli³
¹University Hospital Grenoble-Alpes, ²Grenoble Alpes University Hospital

P1-G-49 Using virtual reality to safely increase mobility-related anxiety when turning in simulated environments
Presenter: Tiphanie Raffegueau
Tiphanie Raffegueau¹, Mindie Clark¹, Bradley Fawver¹, William Young¹, Mark Williams¹, Keith Lohe³, Peter Fino³
¹University of Utah, ²Brenau University

P1-G-50 Does postural threat influence the StartReAct effect in a lateral stepping task?
Presenter: Vivian Weerdesteyn
Vivian Weerdesteyn¹, Milou Coppers¹, Tim Inglis³, Mark Carpenter²
¹Radboud University Medical Center, ²University of British Columbia

P1-G-51 Dual task gait interference in Parkinson’s disease: The impact of baseline cognitive capacity
Presenter: Rosie Morris
Rosie Morris¹, Ellen Lirani-Silva², Rachael Lawson³, Alison Yarnall¹, Brook Galna¹, Sue Lord³, Lynn Rochester³
¹Oregon Health & Science University, ²São Paulo State University (UNESP), ³Newcastle University, ⁴Auckland University of Technology, ⁵Institute of Neuroscience, Newcastle University, ⁶University of Auckland, ⁷University of British Columbia, ⁸Newcastle University

P1-G-52  The multiscale dynamics of resting-state brain activity is associated with the performance of dual task standing postural control in older adults
Presenter: Junhong Zhou
Junhong Zhou¹, Laura Dubreuil Vail², Brad Manor³, Giulio Ruffini⁴
¹Harvard Medical School, ²Neuroelectrics
H - Coordination of posture and gait
P1-H-53  Combined diabetes and arthritis are associated with declined gait speed
Presenter: Bader Alqahtani
Bader Alqahtani¹, Ageel Alenazi¹, Mohammed Alshehri²
¹Prince Sattam Bin Abdulaziz University, ²Jazan University
P1-H-54  Healthy young adults use vision for postural control similarly at low and high virtual heights
Presenter: Eric Anson
Eric Anson¹, Nicole Kuznetsov¹, Raul Rodriguez², Kyle Critelli¹, Benjamin Crane¹
¹University of Rochester
P1-H-55  Body sway is mediated by vestibular cortical dominance
Presenter: Adolfo Bronstein
Adolfo Bronstein¹, Patricia Castro¹, Diego Kaski², Hussein Al-Fadly¹, Deniz Ak¹, Liam Oktay¹, Qadeer Arshad¹
¹Imperial College London, ²University College London
P1-H-56  Postural balance at children survived after posterior fossa tumor
Presenter: Anna Dreneva
Dmitry Skvortsov¹, Anna Dreneva¹, Vladimir Kasatkine², Alexander Karelin³
¹Queensland University of Technology, ²University of Queensland, ³Dance for Parkinson’s Australia and Queensland Ballet
P1-H-58  Balance mechanisms differ across cadences on a self-paced treadmill
Presenter: Tyler Fettrow
Tyler Fettrow¹, David Grenet³, Hendrik Reimann¹, Ian Sotnek¹, Elizabeth Kaye¹, Maelyn Arcodia¹, John Jeka¹
¹University of Delaware
P1-H-59  The ability to switch from a trail limb avoidance to a lead limb accommodation strategy
Presenter: Félix Fiset
Félix Fiset¹, Bradford McFadyen¹
¹Université Laval
P1-H-60  Specificity of trunk postural responses to three-dimensional surface stimuli
Presenter: Adam Goodworth
Adam Goodworth¹, Cody Barrett², Jonathan Rylander², Brian Garner³
¹University of Hartford, ²Baylor University
P1-H-61  The effects of intensive balance training in individuals with chronic spinal cord injury on quiet standing centre of pressure measures
Presenter: Olinda Habib Perez
Olinda Habib Perez¹, Janelle Unger¹, Katherine Chan¹, Jae Lee¹, Kei Masani³, Kristin Musselman¹
¹Toronto Rehabilitation Institute, ²University of Toronto
P1-H-62  Arm swing and gait symmetry affects gait stability and interlimb coordination
Presenter: Allen Hill
Allen Hill¹, Julie Nantel¹
¹University of Ottawa
P1-H-63  Kinesiological study for normal walking gait on irregular surface
Presenter: Kenta Igarashi
Kenta Igarashi¹, Koichiro Koganezawa¹
¹Tohoku University
P1-H-64  Effects of Dance for Parkinson’s on gait and dual-task gait in Parkinson’s disease assessed using Vicon 3D-motion capture
Presenter: Graham Kerr
Nadeesha Kalyani¹, Karen Sullivan¹, Gene Moyle¹, Sandy Brauer¹, Erica Rose Jeffrey², Graham Kerr¹
¹University of Prince Edward Island, ²University of Guelph
P1-H-65  Gross and fine balance control during walking in stroke patients and healthy controls
Presenter: Noel Keijser
Noel Keijser¹, Yara Luijten¹, Bart Nienhuis³
³Sint Maartenskliniek
P1-H-66  Effects of freezing joint degrees of freedom on dynamic postural balancing
Presenter: Kentaro Kodama
Kentaro Kodama¹, Kazuhiro Yasuda², Hideo Yamagawa³
¹Kanagawa University, ²Waseda University, ³Tokyo Metropolitan Tobu Medical Center
P1-H-67  Ankle and hip joint coordination during quiet standing for individuals with incomplete spinal cord injury
Presenter: Jae Lee
Jae Lee¹, Angela (Jae-eun) Yoo², Katherine Chan³, Janelle Unger¹, Kristin Musselman¹, Kei Masani³
¹University of Toronto, ²Institute of Biomaterials and Biomedical Engineering, ³University of Toronto, ⁴Toronto Rehabilitation Institute
P1-H-68  Variability of gait, bilateral coordination in unilateral vestibular loss patients
Presenter: Hwan Ho Lee
Hwan Ho Lee¹
¹Korea University College of Medicine, Korea
P1-H-69  Walking through an aperture while penetrating from the paretic side reduces the rate of collision for stroke individuals
Presenter: Daisuke Munro
Daisuke Munro¹, Yutaro Saito¹, Aki Koyake¹, Takahiro Higuchi²
¹Kameda Medical Center, ²Tokyo Metropolitan University
P1-H-70  Feasibility of visual cues to promote walking turns in Parkinson’s disease
Presenter: Rebecca Reed-Jones
Rebecca Reed-Jones¹, Tyler Baker¹, Jenna Pitman²
¹University of Prince Edward Island, ²University of Guelph
P1-H-71  Haste makes waste: on the trade-off between walking speed and target-stepping accuracy
Presenter: Melvyn Roerdink
Melvyn Roerdink¹, Daphne Geese², Lieke Peper³
¹Vrije Universiteit Amsterdam
P1-H-72  Influence of body weight supported treadmill training parameters on muscle coordination in hemiparetic walking
Presenter: Bryant Seamon
Bryant Seamon¹, Shraddha Srivastava¹, Richard Neptune², Lindsay Perry², Carolynn Patten², Steven Kautz³
¹York H. Johnson VA Medical Center, ²University of Texas at Austin, ³University of St. Augustine for Health Sciences, ⁴University of California Davis School of Medicine
P1-H-73  Comparative characteristics of obstacle avoidance strategy in young and older adults in various walking conditions
Presenter: Kotaro Shimizu
Kotaro Shimizu¹, Yuriko Kihara¹, Koki Iwata¹, Takahiro Higuchi¹, Taketo Furuna²
¹Sapporo Medical University, ²Japan Health Care College, ³Department of Health Promotion Science, Tokyo Metropolitan University
P1-H-74  Does discrete versus cyclic full body reaching tasks influence hip and spine excursions?
Presenter: James Thomas
James Thomas¹
¹Virginia Commonwealth University
I - Development of posture and gait
P1-I-75  The development of running in children
Presenter: Margit Bach
Margit Bach¹, Francesco Menna², Andreas Daffertshofer¹, Nadia Dominici³
¹Vrije Universiteit Amsterdam, ²University of Rome Tor Vergata
P1-I-76  Evaluation of balance in adolescent idiopathic toe walkers
Presenter: Marybeth Grant-Beuttler
Marybeth Grant-Beuttler¹, R. Caprice Hollandsworth¹, Shweta Chheda¹, Richard Beuttler¹, Afshin Aminian¹, Rahul Soaangra¹
¹Vrije Universiteit Amsterdam
P1-I-77 Reactive and anticipatory postural response mechanisms during continuous platform oscillation in children and adolescents

Presenter: Richard Mills
Richard Mills¹, Heidi Sveistrup²
1Manchester Metropolitan University, ²University of Ottawa

P1-I-78 Children’s walking in complex environments: One step at a time?

Presenter: Rachel Mowbray
Rachel Mowbray¹, Janna Gottwald³, Manfei Zhao¹, Anthony Atkinson¹, Dorothy Covey¹
1Durham University, ²Upssala University

P1-I-79 Inertial sensor based normative postural sway parameters in typically developing children and young adults

Presenter: Joan Ann O’Keefe
Joan O’Keefe¹, Alexandra Palmer¹, Rachel Tracy¹, Stephanie Voss¹, Medha Parulekar¹, Caitlin Bailey¹, Nicollette Purcill¹, Elizabeth Berry-Kravis¹
1Rush University Medical Center

P1-I-80 Inertial sensor based normative spatiotemporal gait and Timed Up And Go parameters in typically developing children and young adults

Presenter: Joan Ann O’Keefe
Joan O’Keefe¹, Alexandra Palmer¹, Rachel Tracy¹, Stephanie Voss¹, Medha Parulekar¹, Nicollette Purcill¹, Marie Fefferman¹, Elizabeth Berry-Kravis¹
1Rush University Medical Center

P1-I-81 Minimum Predicted Distance: Applying a common metric to collision avoidance strategies between typically developing children and adult walkers

Presenter: Victoria Rapos
Victoria Rapos¹, Michael Cinelli¹, Natalie Snyder¹, Arnel Cretu², Anne-Hélène Olivier²
1Wilfrid Laurier University, ²University of Antwerp

P1-I-82 Experimental study of biomechanics of “military crawl” locomotion, pilot study

Presenter: Dmitry Skvortsov
Dmitry Skvortsov¹, Alina Aisenshtein², Vladimir Kasatkin¹, Anatoliy Shipilov², Victor Anisimov²
1Government University, ²Rehabilitation center “Russoe Pole”, ³Dmitry Rogachev National Research Center of Pediatric Hematology, Oncology and Immunology

J - Developmental disorders

P1-J-83 Effects of saccadic eye movements on postural stabilization in dyslexic children

Presenter: Jose Barelá
Jose Barelá¹, Newton Tesima², Vitor Amaral², Ana Barelá²
1São Paulo State University (UNESP), ²Unicentro do Sul University

P1-J-84 Effects of neuralization of symmetry of the Maxwell spot on postural control in children with dyslexia. Clinical cases report

Presenter: Marc Janin
Emmanuelle Pirson Braquet¹, Marc Janin², Alix Couvrat³, Claire Carraurer¹, Lucie Piroleau¹, Marina Vincent¹, Marion Miral¹, Sophie Richer de Forge¹, Tiphaine Drellard¹, Valerie Riviere¹, Benoît Maille¹, Nicolas Imbert¹, Briskmann Didier³
1YODOLOGIE, ²Université de Pau et des pays de Léadour, ³Krys Poitiers

P1-J-85 The Kids-BESTest of postural control predicts gross motor coordination in primary school children with and without coordination difficulties

Presenter: Leanne M Johnston
Leanne Johnston¹, Gemma Allinson¹, Breanna Raatz¹, Rosalée Deew¹, Sally Hannan¹
1University of Queensland

P1-J-86 Developmental Coordination Disorder co-occurs at high rates among children and adolescents with Autism Spectrum Disorder

Presenter: Haylie Miller
Haylie Miller¹, Gabriela Sherrod², Priscila Caçola³
1University of North Texas Health Science Center, ²University of Alabama, Birmingham, ³University of Texas at Arlington

P1-J-87 Effect of orthopaedic shoes and orthopaedic insoles on gait in patients with Dravet syndrome

Presenter: Lore Wyers
Lore Wyers¹, Karen Verheyen¹, Berten Ceulemans¹, An-Sofie Schoonjans¹, Kaat Desloovere¹, Patricia Van de Walle¹, Ann Hallemans¹
1KU Leuven

K - Devices to improve posture and gait

P1-K-88 Improvements in balance control for multiple sclerosis patients with vibro-tactile biofeedback of trunk sway

Presenter: John Allum
John Allum¹, Christel Schouenborg², Bettina Fischer-Barnicq³, Venessa Haller³, Nathanael Lutz³, Heiko Rust³, Oezguer Validizi³
1University Hospital Basel, ²Bern University of Applied Sciences, ³Charing Cross Hospital

P1-K-89 Avoiding 3D holographic obstacles: Does it differ from negotiating real obstacles?

Presenter: Bert Coolen
Bert Coolen¹, Daphne Geerse¹, Melvin Roerdink¹
1Vrije Universiteit Amsterdam

P1-K-90 Evaluating the efficacy of a novel therapeutic tool for standing balance after spinal cord injury: A case series

Presenter: David Houston
David Houston¹, Jae Lee¹, Emerson Grabke³, Angela (Jaeun) Yoo¹, Kai-Lon Fok¹, Janelle Unger¹, Kei Masani¹, Kristin Musselman¹
1Rehabilitation Sciences Institute, University of Toronto, ²University of Toronto, Institute of Biomaterials and Biomedical Engineering, University of Toronto

P1-K-91 Design improvement and clinical assessment of personal standing mobility Qolo for voluntary sit-to-stand posture transition of persons with thoracic level spinal cord injury

Presenter: Hideki Kadone
Hideki Kadone¹, Yukiko Shimizu¹, Shigeki Kubota¹, Diego Paez¹, Yasushi Hada¹, Masashi Yamazaki¹, Kenji Suzuki¹
1University of Tsukuba

P1-K-92 Effects of sensory augmentation activation thresholds on balance performance in people with vestibular disorders

Presenter: Kathleen Sienko
Tian Bao¹, Catherine Kinnaird¹, Wendy Carender¹, Kathleen Sienko¹
1University of Michigan

P1-K-93 Staying UpRight in Parkinson’s disease: A novel postural intervention

Presenter: Samuel Stuart
Samuel Stuart¹, Alan Godfrey², Lynn Rochester³, Fay Horak³, Martina Mancini³
1Oregon Health & Science University, ²Northumbria University, Institute of Neuroscience, Newcastle University

P1-K-94 Gait variability decreases with use of carbon fiber footplates in children with idiopathic toe walking

Presenter: Srikant Vallabhajosula
Srikant Vallabhajosula¹, Melissa Scales¹
1Univris University

P1-K-95 Treadmill training in a virtual environment improves gait and balance in patients with incomplete spinal cord injury

Presenter: Rosanne van Dijseldonk
Rosanne van Dijseldonk¹, L.A.F. de Jong², B.E. Groen³, M. Vos-van der Hulst¹, A.C.H. Geurts³, N.L.W. Keijers³, Yaaboudoum & Sint Maartenskliniek, ²Sint Maartenskliniek, ³Radboud University Medical Center

L - Effect of medication on posture and gait

P1-L-96 Botulinum toxin injection to the upper limb may indirectly improve gait in patients with post-stroke spasticity: an-label prospective pilot study

Presenter: Shani Kimel Naor
Shani Kimel Naor¹, Oren Cohen², Elizabeth Shprits³, Sharon Hassin-Baer¹, Yael Dotan-Marom¹, Gilad Yahalom¹, Oleg Marzeliak¹, Lilach Ephrati¹, Hanna Strauss¹, Rivka Inzelberg¹, Meir Plotnik¹, Sheba Medical Center, Tel-Aviv University, Technion, Technological Institute of Israel, ²Tel-Aviv University

P1-L-97 Evaluation of adult cerebral palsy gait with spasticity of glutous medius anterior fibers before and after local treatment with botulinum toxin

Presenter: Philippe Thoumie
Philippe Thoumie¹, Florence Babany¹
1Hospital Rothschild APHP Sorbonne University
**POSTER SESSION INFO**

### M - Exercise and physical activity

**P1-M-98** Evaluation of measurement properties of the instrumented and repeated Timed Up and Go (SITUG)

*Presenter: Ronny Bergquist*

Ronny Bergquist¹, Corrina Nerz², Kristin Taraldsen¹, Clemens Becker¹, Sabato Mellone¹, Beatrice Vereijken¹, Jorunn Helbstød¹, Stéfanie Mikolaizik²

¹Norwegian University of Science and Technology, ²Robert-Bosch-Krankenhaus, ³University of Bologna

---

**P1-M-99** Controlling the uncontrollable - perceptions of balance in people with Parkinson’s disease

*Presenter: Hanna Johansson*

Hanna Johansson¹, Erika Franzén¹, Kirsti Skavberg Roaldsen¹, Maria Hagström¹, Breifthi Leavy³

³Karolinska Institutet

---

**P1-M-100** Athletes adopt different control strategies compared to non-athletes with increased postural demands

*Presenter: Jenna Pitman*

Jenna Pitman¹, Rhiana Malcolm¹, David Shulman¹, Becky Breau¹, Michael Cinelli², Lori Ann Vallis³

¹University of Guelph, ²Wilfrid Laurier University

---

**P1-M-101** Could lifestyle-integrated exercise accommodate practice effects among lower limb prosthesis users

*Presenter: Gaelle Prigent*

Gaelle Prigent¹, Anisoara Ionescu¹, Wei Zhang¹, Kristin Taraldsen¹, Beatrice Vereijken¹, Jorunn L. Helbstød³, Kiamar Aminian¹

¹Ecole Polytechnique Fédérale de Lausanne (EPFL), ²Norwegian University of Science and Technology, ³University of Bologna

---

**P1-M-102** Predicting physical activity in obese and normal weight older adults based on cognitive and physical function

*Presenter: Noah Rosenblatt*

Noah Rosenblatt¹, Sai Yalla¹

¹Rosalind Franklin University of Medicine and Science

---

**P1-M-103** Posture of lunge motion during a shuttle sprint test in soft tennis elite players

*Presenter: Hidenori Shinohara*

Hidenori Shinohara¹, Koji Kawakami², Kazutaka Takahashi³, Ayane Ogura¹, Kenji Takahashi², Hirofumi Iida¹

¹Nippon Sports Science University, ²Sports Intelligence, ³University of Tsukuba, ⁴Jobu University, ⁵Aichi Gakuten University

---

**P1-M-104** Comparing muscle power and muscle strength training using Thera-band for reducing fall risk in community-dwelling older adults

*Presenter: Kenneth Cheng*

Kenneth Cheng¹, Kim Chan¹

¹Chinese University of Hong Kong

---

**P1-M-105** Is there an optimal recovery step landing range to prevent backward fall from slips: Evidence from large-scale overground slips

*Presenter: Tanvi Bhatt*

Tanvi Bhatt¹, Shajjie Wang², Yiu (Emma) Wang¹

¹University of Illinois at Chicago

---

**P1-N-106** Towards tailored fall prevention: Identifying modifiable risk factors in older people

*Presenter: Femke Hulzinga*

Femke Hulzinga¹, Kimberley Van Schooten¹, Kim Delbaere¹

¹KU Leuven, ²Neuroscience Research Australia

---

**P1-N-107** Falls in a longitudinal Parkinson’s disease cohort: What can we learn from baseline gait assessment in non-fallers over six years?

*Presenter: Heather Hunter*

Heather Hunter¹, Lisa Alcock², Sue Lord³, Rosie Morris⁴, Lynn Rochester², Alison Yarnall⁴

¹Newcastle-upon-Tyne Hospitals NHS Foundation Trust, ²Newcastle University, ³Auckland University of Technology, ⁴Oregon Health & Science University, ⁵Institute of Neuroscience, ⁶Newcastle University

---

**P1-N-108** Motoric Cognitive Risk Syndrome falls incidence and trajectory of gait and cognitive change in an octogenarian cohort: Te Puawaitanga o Ngā Tapuwea Kia Ora Tonu, LILACS NZ

*Presenter: Sue Lord*

Sue Lord¹, Simon Moyes², Ruth Teh², Waiora Port², Marama Muru-Lanning³, Catherine Bacon⁴, Tim Wilkinson⁴, Ngaire Kerse⁵

¹Auckland University of Technology, ²University of Auckland, ³University of Otago

---

**P1-N-109** Increasing plantar somatosensory performance on the one leg stance test in elderly

*Presenter: Emmanuelle Pivron Braquet*

Emmanuelle Pivron Braquet¹, Marc Janin²

¹PODOLOGUE, ²Université de Pau et des pays de l’Adour

---

**P1-N-110** Aggressive proactive balance training using a multi-directional harness system and adapted video gaming: A case series

*Presenter: Ann Reintahl*

M Ann Reintahl¹, Debbie Espy³, Lorenzo Bianco¹, John DeMarco², Emily Punchak¹

¹Cleveland State University

---

**P1-N-111** Effect of the rate of change of an external balance perturbation

*Presenter: Thomas Robert*

Thomas Robert¹, Marine Guinamard², Laurence Cheze¹, Marie-Laure Mille³

¹Université de Lyon, ²Aix Marseille Université

---

**P1-N-112** Administration and scoring procedures for performance-based clinical balance tests do not accommodate practice effects among lower limb prosthesis users

*Presenter: Andrew Sawers*

Andrew Sawers¹, Brian Hafner²

¹University of Illinois at Chicago, ²University of Washington

---

**P1-N-113** Kinematic analysis of videos of real-life falls in older adults using Kinovea software

*Presenter: Nataliya Shishov*

Nataliya Shishov¹, Karam Elabd¹, Vicki Komisar¹, Stephen Robinovitch³

¹Simon Fraser University

---

**P1-N-114** Dynamic stability measures respond uniquely to destabilization during asymmetric walking

*Presenter: Tarique Siragy*

Tarique Siragy¹, Julie Nanten³

¹University of Ottawa

---

**P1-N-115** Total knee replacement patient’s preoperative time to recovery expectations are related to fall risk

*Presenter: Brian Street*

Brian Street¹

¹California State University, Bakersfield

---

**P1-N-116** Posturography differences between recurrent and non-recurrent fallers

*Presenter: Kyra Twohy*

Kyra Twohy¹, Vinayak Vijayan³, Kimberly Bigelow¹

¹University of Dayton

---

**P1-N-117** An examination of muscle quality, functional test performance and fall risk in “young-old” women: A pilot study

*Presenter: Jodi Venture*

Jodi Venture¹, Christopher Morse², David Tomlinson¹, Chesney Craig³

¹Manchester Metropolitan University

---

**P1-N-118** Treadmill gait-slip training in healthy community-dwelling older adults: Mechanisms of within trial adaptation for a progressive ascending-and-mixed intensity protocol

*Presenter: Yiru Wang*

Yiru Wang¹, Shajjie Wang², Anna Lee³, Clive Pai⁴, Tanvi Bhatt¹

¹University of Illinois at Chicago, ²Retired from University of Illinois at Chicago

---

**P1-N-119** The effects of time-pressure on adaptive gait in individuals with and without central vision loss

*Presenter: Tjerk Zult*

Tjerk Zult¹, Matthew Timmis¹, Jonathan Alisop², Shamina Pardhan¹

¹Anglia Ruskin University, ²Royal Air Force College Cranwell
P1-O-120 Instrumenting gait and balance assessment at home and in the community: exploratory data from the ACTIVATE feasibility study
Presenter: Christopher Buckley
Christopher Buckley¹, Silvia Del Din¹, Patrica McCue², Heather Hunter¹, Sue Lord¹, Chris Price¹, Lisa Shaw², Helen Rogers³, Lynn Rochester⁴, Sarah Moore⁴
¹Newcastle University, ²Newcastle-upon-Tyne Hospitals NHS Foundation Trust, ³University of Technology, Institute of Neuroscience, Newcastle University

P1-O-121 Targeted transcranial electric stimulation mitigates the dual task cost to gait speed in older adults
Presenter: Brad Manor
Brad Manor¹, Junhong Zhou¹, On-Ye Lo¹, Alexa Ludington¹, Rachael Katz¹, Marina Brozgol², Pablo Cormejo Thumm³, Jeff Hausdorff⁴
¹Harvard Medical School, ²Tel-Aviv Sourasky Medical Center

P1-O-122 Perturbation induced stepping in stroke: a way to use the involved leg
Presenter: Katherine M Martinez
Katherine Martinez¹, Mary Blackinton², M. Samuel Cheng³, Mark Rogers⁴, Marie-Laure Mille⁵
¹Northwestern University Feinberg School of Medicine, ²Nova Southeastern University, ³University of Maryland, ⁴Aix Marseille University, ⁵Marseille University

P1-O-123 The effect of an exergame intervention on clinical balance scales in children with cerebral palsy: Preliminary results from two non-randomized trials
Presenter: Pieter Meyns
Pieter Meyns¹, Jan Blanchkaer², Chloé Bras³, jaap Harlaar³, Laura van de Pol³, Frederik Barkhof², Hilde Van Waehelde³, Annemieke Buizer³
¹University of Amsterdam, ²Delft University of Technology, ³University of Technology, Institute of Neuroscience, Newcastle University

P1-O-124 How do spatiotemporal gait parameters change from the acute phase to 3 months later following a stroke?
Presenter: Ole Petter Norvang
Ole Petter Norvang¹, Torunn Aaskim², Anne Eitrem², Pernille Thingstad²
¹Norwegian University of Science and Technology, ²Trondheim University Hospital

P1-O-125 Robotic intervention improves lateral gait symmetry in acute post-stroke patients
Presenter: Chun Kwang Tan
Chun Kwang Tan¹, Hideki Kadone¹, Hiroki Watanabe¹, Aki Marushima¹, Yasushi Hada¹, Masashi Yamazaki¹, Yoshiyuki Sankai¹, Kenji Suzuki¹
¹University of Tsukuba, ²Faculty of Medicine, University of Tsukuba Hospital

P1-P-126 Collision avoidance between walkers with a twist: Strategies for curvilinear and rectilinear paths
Presenter: Anne-Hélène Olivier
Anne-Léna Lynch¹, Richard Kulpa¹, Laurentiers Meerkhoff⁵, Anthony Sorel², Julien Pettre³, Anne-Hélène Olivier¹
¹University of Rennes / Inria, ²Inria Rennes

P1-P-127 Identification of gait characteristics for early diagnosis of Parkinson’s disease with machine learning
Presenter: Rana Zia Ur Rehman
Rana Zia Ur Rehman¹, Silvia Del Din¹, Yu Guan¹, Jian Qing Shi¹, Lynn Rochester²
¹Newcastle University, ²Institute of Neuroscience, Newcastle University

Q - Neurological diseases
P1-Q-128 Influence of mild impairment of Parkinson’s disease on gait initiation
Presenter: Ana Barelá
Ana Barelá¹, Giovanna Machado¹, Douglas Russo-Junior¹, Flávia Dosá¹, Henrique Ferraz¹, Jose Barelá¹
¹Cruzeiro do Sul University, ²Federal University of São Carlos (UFSCar), ³São Paulo State University (UNESP)

P1-Q-129 The habituation of postural responses to perturbations is delayed in people with Parkinson’s disease
Presenter: Victor Beretta
Victor Beretta¹, Mark Carpenter², Fabio Barbieri³, Paulo Cezar Santos¹, Diego Orcioli-Silva¹, Marcelo Pereira¹, Lilian Godói¹
¹São Paulo State University (UNESP), ²University of British Columbia

P1-Q-130 Perception of verticality correlates with postural and balance deficits in patients with Parkinson disease
Presenter: Gaia Bonassi
Gaia Bonassi¹, Laura Mori¹, Martina Putzuol¹, Chiara Ponte¹, Alessandro Botta¹, Giovanna Lagravinese¹, Laura Avanzino¹, Elisa Pelosi²
¹University of Genova

P1-Q-131 Repetitive head impacts do not impair single task gait in collegiate ice hockey players
Presenter: Thomas Buckley
Thomas Buckley¹, Melissa diFabio¹, Jessie Oldham², Katherine Breedlove³, Curtis Johnson¹
¹University of Delaware, ²Boston Children’s Hospital, ³University of Michigan

P1-Q-132 Cholinergic upregulation in dorsomedial thalamus prior to conversion to freezing of gait in Parkinson’s disease
Presenter: Nicholas D’Cruz
Nicholas D’Cruz¹, Martijn Muller², Prabhesh Kanel³, Alice Nieuwboer¹, Nicos Bohnen¹
¹KU Leuven, ²University of Michigan

P1-Q-133 Turning velocity and coordination in multiple sclerosis
Presenter: Lee Dibble
Brian Loyd¹, Grace Hunt¹, Annie Fangman¹, Peter Fino¹, Lee Dibble¹
¹University of Utah

P1-Q-134 The neural correlates of motor imagery of medio-lateral dynamic balance in Parkinson’s disease
Presenter: Bauke Dijkstra
Bauke Dijkstra¹, Morin Gilat¹, Aiki Marushima², Yasushi Hada¹, Masashi Yamazaki¹, Chun Kwang Tan¹, Hideki Kadone¹, Hiroki Watanabe¹, Aki Marushima¹, Yasushi Hada¹, Masashi Yamazaki¹, Yoshiyuki Sankai¹, Kenji Suzuki¹
¹KU Leuven

P1-Q-135 Effect of dopamine on medio-lateral dynamic balance in Parkinson’s disease and freezing of gait
Presenter: Morin Gilat¹, Bauke Dijkstra¹, Alice Nieuwboer¹
¹KU Leuven

P1-Q-136 Effects of perturbation-based balance training on balance, gait and balance confidence in subacute persons with stroke: A randomized controlled trial
Presenter: Shirley Handelzalts
Shirley Handelzalts¹, Michal Kanner-Furman¹, Ganit Gray¹, Nachum Soroker¹, Itshak Melzer¹
¹Ben-Gurion University, ²Gesher Rehabilitation Hospital

P1-Q-137 The effect of combined transcutaneous direct current stimulation and locomotor training on spinal excitability in an individual with chronic spinal cord injury
Presenter: Kelly Hawkins
Kelly Hawkins¹, Lou DeMark², Arian Vistamehr¹, Geneva Tonuzi¹, David Fuller¹, David Clark², Emily Fox³
¹University of Hong Kong, ²Brooks Rehabilitation, ³Malcolm Randall VA Medical Center, University of Florida

P1-Q-138 The differences in sagittal plane whole-body angular momentum during gait between patients with hemiparesis and healthy people
Presenter: Keita Honda
Keita Honda¹, Yusuke Sekiguchi¹, Takayuki Muraki¹, Shin-Ichi Izumi¹
¹Tohoku University

P1-Q-139 Unravelling quantitative measures of free-living ataxic gait in cerebellar patients using wearable sensors
Presenter: Winfried Ilg
Winfried Ilg¹, Jens Seemann¹, Matthias Synofzik²
¹Yerkes Institute for Clinical Brain Research

P1-Q-140 Can transcranial direct current stimulation improve gait initiation in individuals with Parkinson’s disease?
Presenter: Jonathan Lommen
Jonathan Lommen¹, Anthony Carlsen¹, Julie Nantel¹
¹University of Ottawa
P1-Q-141 Electromyographic profiles of gait initiation in people with Parkinson's disease: The effects of external sensory cueing  
Presenter: Colum MacKinnon  
Colum MacKinnon¹, Lesley Perg¹, Chiahao Lu¹, Matthew Petrucci¹, Abigail Kohut-Jackson¹, Paul Tuite¹, Sommer Amundsen Huffman¹  
¹University of Minnesota

P1-Q-142 The effects of obstacle size and timing on prefrontal cortex activation in patients with Parkinson's disease  
Presenter: Inbal Maida  
Inbal Maida¹, Topaz Sharon¹, Ilan Kurz², Hagar Bernad-Elazari¹, Shiran Shustak¹, Ira Galperin¹, Anat Mirelman¹, Jeff Hausdorff²  
¹Tel-Aviv Sourasky Medical Center, ²Ben-Gurion University

P1-Q-143 Post-stroke walking characteristics on association between motor paralysis and walking speed by cluster analysis  
Presenter: Naomichi Mizuta  
Naomichi Mizuta¹, Yusaku Takamura¹, Shinatoire Fujii¹, Naruhito Hasui¹, Tomoki Nakatani², Masako Tsutsumi², Junji Taguchi¹, Shu Morioka³  
¹Department of Neurorehabilitation, Graduate School of Health Sciences, Kio University; ²Takarazuka Rehabilitation Hospital; ³Kio University

P1-Q-144 Reweighting of sensory information during gait in Parkinson's disease  
Presenter: Marcelo Pereira  
Marcelo Pereira¹, Quinncy Ameida³, Lilian T. Gobbi³  
¹São Paulo State University (UNESP), ²Wilfrid Laurier University, ³UNESP - Rio Claro

P1-Q-145 Brain functional connectivity changes associated to freezing of gait in Parkinson's disease  
Presenter: Alexandra Potvin-Dresrochers  
Alexandra Potvin-Dresrochers¹, Trina Mitchell¹, Thomas Gisiger¹, Caroline Paquette¹  
¹McGill University

P1-Q-146 Occupational therapy intervention to improve the quality of life of client with Friedreich's Ataxia- A case study of complete rehabilitation from dependent living to independently  
Presenter: Deepa Pradhan  
Deepa Pradhan¹  
¹Mumbai University

P1-Q-147 Can saccadic eye movements minimize the deleterious effect of ankle muscle fatigue on postural control in people with Multiple Sclerosis?  
Presenter: Felipe Santinelli  
Felipe Santinelli¹, Emerson Sebastião², Fabiana Silva¹, Gabriel Moretto¹, Luiz Felipe Imaizumi¹, Lucas Simiel³, Richard Van Emmerik², Fabio Barbieri²  
¹São Paulo State University (UNESP); ²Northern Illinois University; ³University of Massachusetts

P1-Q-148 Adaptive capacity to split-belt treadmill walking of people with Parkinson's disease with freezing of gait  
Presenter: Jana Seuth  
Jana Seuth¹, Nicholas D'Cruz², Pieter Gini², Burkhard Weisser¹, Alice Nieuwboer³, Christian Schlenstedt³  
¹Christian-Albrechts-University of Kiel; ²KU Leuven; ³KU Leuven

P1-Q-149 Dual task gait cost in Parkinson's disease patients with and without depressive symptoms  
Presenter: Carolina Silveira  
Carolina Silveira¹, Frederico Pierucinni-Faria², Eric Roy³, Quinncy Almeida²  
¹Lawson Health Research Institute, ²University of Western Ontario; ³University of Waterloo; ⁴Wilfrid Laurier University

P1-Q-150 Automatic detection of Bradykinesia in Parkinson's disease  
Presenter: Elke Warmerdam  
Elke Warmerdam¹, Gerhard Schmidt², Clint Hansen¹, Walter Maetzler¹, Rana Zia Ur Rehman³  
¹Christian-Albrechts-University of Kiel; ²Kiel University; ³University of Ottawa

P1-Q-151 Non-invasive vagus nerve stimulation: A non-pharmacological approach to target gait impairment in Parkinson's disease?  
Presenter: Alison Yarnall  
Alison Yarnall¹, Rosie Morris², John-Paul Taylor³, Mark Baker¹, Lynn Rochester²  
¹Newcastle University; ²Oregon Health & Science University; ³Institute of Neuroscience, Newcastle University

P1-Q-152 Using analogies to overcome freezing of gait: A first step towards making the first step  
Presenter: Will Young  
William Young¹, Amy Maslilvec², Anna Fielding¹, Mark Wilson², Meriel Norris¹, John Cossar¹  
¹Brunel University; ²University of Exeter

R - Orthopedic diseases and injuries

P1-R-153 Functional electrical stimulation during gait following anterior cruciate ligament reconstruction - A preliminary study  
Presenter: Shmuel Springer  
Shmuel Springer¹, Uria Moran², Utti Gottlieb³, Arnon Gam²  
¹Ariel University; ²IDF Medical Corps

S - Proprioceptive function and disorders

P1-S-154 How varying levels of skin stretch affect perceived skin stretch sensitivity  
Presenter: William MacDonald  
William MacDonald¹, Simone Smith¹, Shawn Beaudette¹, Stephen Brown¹, Leah Bent¹  
¹University of Guelph; ²University of Ottawa

U - Robotics

P1-U-155 Reshaping of gait coordination with robotic intervention in myelopathy patients with residual motor disturbances after surgery  
Presenter: Sandra Puentes  
Sandra Puentes¹, Hideki Kadone¹, Shigeki Kubota¹, Tetsuya Abe¹, Yukio Shimizu¹, Yasushi Hada¹, Aki Marushima¹, Masashi Yamazaki¹, Yoshihuki Sankai¹, Kenji Suzuki¹  
¹University of Tsukuba; ²Faculty of Medicine, University of Tsukuba Hospital
P1-V-162  Balance control in young adult athletes with a history of recent concussion (> 3 months) during a lower limb reaching task
Presenter: Katelyn Mitchell
Katelyn Mitchell¹, Michael Cinelli¹
¹Wilfrid Laurier University

P1-V-163  Light touch with two hands rather than one more effectively reduces postural sway, but number of contact points does not similarly influence the effectiveness of the haptic anchors in older adults
Presenter: Renato Moraes
Renato Moraes¹, Bruno Bedo¹, Vitor Arpini¹, Rosangela Batista¹, Paulo Santiago¹, Eliane Mauerberg-deCastro²
¹University of São Paulo, ²São Paulo State University (UNESP)

P1-V-164  Adaptability of human gait: Effect of training with red noise auditory stimuli on gait fluctuation patterns
Presenter: Cecilia Power
Cecilia Power¹, Jeevaka Kiriella¹, Janessa Drake¹, William Gage¹
York University

P1-V-165  Assessment of balance after repeated sub-concussive head trauma in female athletes
Presenter: Christopher Rhea
Christopher Rhea¹, Sam DuBois¹, Victoria Blevins¹, Kristen Schleich², Scott Ross¹, Donna Duffy¹
¹University of North Carolina, Greensboro, ²Elon University

P1-V-166  Effect of the horizontal-vertical illusion on stepping over-action
Presenter: Ryota Sakurai
Ryota Sakurai¹, Kentaro Kodama¹, Yu Ozawa¹
¹Tokyo Metropolitan Institute of Gerontology, ²Kanagawa Institute of Geriatrics, ³Waseda University

P1-V-167  Sensory weighting and organization strategies used by young adults with CLBP during standing
Presenter: Jennifer Sansom
Jennifer Sansom¹, Karen Lomond²
¹Central Michigan University, ²Athens College

P1-V-168  Associations between motor cortex inhibition and stable turning characteristics in healthy controls and people with Multiple Sclerosis
Presenter: Clayton Swanson
Clayton Swanson¹, Andrew Monaghan¹, Sutton Richmond², Tyler Whittier², Brett Fling²
¹Colorado State University

P1-V-169  W - Tools and methods for posture and gait analysis
Presenter: Michele Barbera
Michele Barbera¹, Nicolo Barbera¹, Emanuele Barbera³, Andrea Fregoni¹
¹Studio Dentistico Barbera, ²Università degli Studi di Milano

P1-V-170  Loading response peak anchoring: A novel solution for the double-belt problem
Presenter: Oran Ben-Gal
Oran Ben-Gal¹, Glen Doniger¹, Maya Cohen¹, Michal Schneider-Beer¹, Meir Plotnik²
¹Sheba Medical Center

P1-W-171  Evaluation of balance recovery from unpredictable large-magnitude perturbations through the compensatory arm and leg movements (CALM) scale
Presenter: Marina Betelli
Marina Betelli¹, Marisa Betelli¹, Patricia Takazono¹, Caroline Souza¹, Julia Oliveira¹, Daniel Coelho¹, Jacques Duyzens²
¹University of São Paulo, ²Catholic University of Leuven

P1-W-172  An evaluation of a proprietary motion capture system via kinematic analysis
Presenter: Vincenzo Di Bacco
Vincenzo Di Bacco¹, Dmitry Verniба¹, William Gage¹
¹York University

P1-W-173  Estimating lateral margin of stability during walking and turning using inertial sensors
Presenter: Peter Fino
Peter Fino¹, Carolin Curzê²
¹University of Utah, ²University of Nebraska Omaha

P1-W-174  Automated and quantification of the tandem walking using a wearable device
Presenter: Natalie Ganz
Natalie Ganz¹, Eran Gazit¹, Amit Hadad¹, Aron Buchman¹, Anat Mirelman¹, Jeff Hausdorff¹
¹Tel-Aviv Sourasky Medical Center, ²Tel Aviv University, ³ Rush Alzheimer's Disease Center

P1-W-175  Creating and validating a shortened version of the community balance & mobility scale for application in young seniors
Presenter: Katharina Gordt
Katharina Gordt¹, A.Stefanie Mikolaiazi¹, Kristin Taraldsen¹, Ronny Bergquist², Jeanine Van Ancum³, Corinna Nerd³, Mirjam Pijnappels³, Andrea Maier⁴, Jorunn Helbostad², Beatrix Vereijken⁵, Clemens Becker¹, Michael Schwenk¹
¹Network Aging Research, ²Robert-Bosch-Krankenhaus, ³Norwegian University of Science and Technology, ⁴Vrije Universiteit Amsterdam, ⁵Heidelberg University

P1-W-176  Towards better quantification of freezing of gait in Parkinson's disease: The added value of performance timing
Presenter: Taliya Herman
Taliya Herman¹, Talia Herman-Feinstein¹, Moria Dagan¹, Shirley Shema-Shiratzky¹, Marina Brozgol¹, Tal Reches¹, Nir Giladi¹, Brad Manor¹, Jeff Hausdorff¹
¹Tel-Aviv Sourasky Medical Center, ²Tel Aviv University, ³Harvard Medical School

P1-W-177  Test-retest reliability of force plate balance measures in individuals with chronic stroke
Presenter: Andrew Huntley
Andrew Huntley¹, Elise Belhace¹, Raabea Aryan¹, Alison Schinkel-Ivy¹, Anthony Aqui¹, April Mansfield¹
¹Ontario Rehabilitation Institute, ²Institut ESPIE Créteil (ISES), ³University of Toronto, ⁴Nipissing University

P1-W-178  Peak plantar ankle flex push-off power estimation using single inertial measurement units
Presenter: Xianta Jiang
Xianta Jiang¹, Mohsen Gholami¹, Janice Eng¹, Carlo Menon¹
¹Simon Fraser University, ²University of British Columbia and GF Strong Rehab Centre

P1-W-179  Reliability of different clinical techniques for assessing foot posture
Presenter: Muge Kirmizi
Muge Kirmizi¹, Mehmet Cakiroglu², Ibrahim Simsek³, Ata Elvan¹, Salkh Angin¹
¹Dokuz Eylül University

P1-W-180  Factors associated with daily variation in gait performance in older adults
Presenter: Alexa Ludington
Alexa Ludington¹, Junhong Zhou¹, Wanting Yu¹, Brad Manor², On-Yee Lo³
¹Harvard Medical School

P1-W-181  Development of instrumented shoe with miniature high-capacity load vector sensor and application to gait assessment
Presenter: Masato Shindo
Masato Shindo¹, Takeshi Yamaguchi¹, Yoshihiro Sasaki¹, Kazuo Hokkirigawa¹
¹Tohoku University, ²Research Institute for Electromagnetic Materials

P1-W-182  Validity and usability of a mixed reality headset for automated mobility assessment
Presenter: Ruopeng Sun
Ruopeng Sun¹, Roberto Aldunate¹, Jacob Sosnoff¹
¹University of Illinois at Urbana-Champaign

P1-W-183  Can we elicit increasing lumbar flexion movement using a standardized reaching paradigm in an immersive virtual reality environment?
Presenter: Susanne van der Veen
Susanne van der Veen¹, Dana Nocera¹, Kellen Kubik¹, Emma Fish², James Thomas³
¹Virginia Commonwealth University, ²Ohio University

P1-W-184  Quantification of seated balance control using system identification
Presenter: Albert Vette
Albert Vette¹, Kshitij Agarwal¹, Ailreza Noamani¹, Andrew Williams¹, Hossein Rouhani¹
¹University of Alberta

Poster Session Info

Poster Session Info
**X - Vestibular function and disorders**

**P1-X-185** Postural instability in subjects with Usher syndrome

Presenter: Simona Caldani, Simona Caldani¹, Maria Pia Bucci¹, Maud Tisse², Isabelle Audoin², Thierry Van Den Abbeele¹, Sylvette Wiener-Vacher¹

¹Hospital Robert Debré, ²CHNO Paris, ³University of Paris, ⁴University of Saint-Etienne, ⁵University of Tours, ⁶University of Clermont Auvergne, ⁷University of Lyon, ⁸University of Limoges, ⁹University of Poitiers, ¹⁰University of Nantes, ¹¹University of Bordeaux, ¹²University of Toulouse

**P1-X-186** Balance performance in bilateral vestibulopathy in relation to sensorimotor integration

Presenter: Nolan Herssens

Nolan Herssens¹, Evi Verbeque², Wim Saeys¹, Luc Vereeck¹, Vincent Van Rompaey¹, Christopher Crumm³, Kenneth Meijer¹, Ann Hallemans¹

¹University of Antwerp, ²University of Hasselt, ³Maastricht University

**P1-X-187** Determination of an objective threshold for galvanic vestibular stimulation

Presenter: Youstina Mikhail

Youstina Mikhail¹, Jean-Marc Mac-Thiong², Dorothy Barthélémy²

¹Centre for Interdisciplinary Research in Rehabilitation (CIRRIRGILM), ²CLISS Centre-Sud-de-l’Île-de-Montréal, ³Université de Montréal

**P1-X-188** Evaluation of after-effects of noisy vestibular stimulation on vestibular motion perception

Presenter: Max Wühr

Max Wühr¹, Aram Keyvan¹, Klaus Jahn¹

¹Ludwig-Maximilians Universität München

**P1-X-189** Body equilibrium function in the course of Ménière’s disease

Presenter: Masahiko Yamamoto

Masahiko Yamamoto¹

¹Tohoku University

**Y - Visual function and disorders**

**P1-Y-190** A perceptual perspective: Exploring visual search patterns during freezing of gait in Parkinson’s disease

Presenter: Lotte Hardeman

Lotte Hardeman¹, Elmar Kal², Toby Ellmers², Will Young³, Anna Fielding³

¹Vrije Universiteit Amsterdam, ²Brunel University

**P1-Y-191** Examining the relationship between visual acuity, executive function and postural control in cognitively healthy adults and adults with Alzheimer’s dementia

Presenter: Susan Hunter

Susan Hunter¹, Alison Divine², Humberto Omana³, Andrew Johnson¹, Jeff Holmes¹, Keith Hill¹, Walter Wittich⁴

¹University of Western Ontario, ²University of Leeds, ³Curtin University, ⁴University of Montreal

---

**POSTER SESSION 2: TUESDAY 2ND JULY**

**A - Activity monitoring**

**P2-A-1** The effect of sensor location on the assessment of sit-to-stand transitions

Presenter: Arash Atrasei

Arash Atrasei¹, Benoît Mariani², Kamari Aminian¹

¹École Polytechnique Fédérale de Lausanne (EPFL), ²Gait Up S.A.

**P2-A-2** Real-world steps, cadence and walking bouts estimated by wrist sensor: Effects of aging, obesity and gender in a population-based cohort study

Presenter: Abolfazl Soltani

Abolfazl Soltani¹, Anisooar Ionescu², Pedro Manuel Marques-Vidal³, Kamari Aminian¹

¹École Polytechnique Fédérale de Lausanne (EPFL), ²Department of Internal Medicine of CHUV

**B - Adaptation, learning, plasticity and compensation**

**P2-B-3** Adaptation induced change in overground slip recovery outcomes: Distinct strategies or continuum of an emerging single strategy control

Presenter: Tanvi Bhatt

Tanvi Bhatt¹, Shuaijie Wang¹, Yi-Chung Pai², Yiru Wang¹

¹University of Illinois at Chicago, ²Retired from University of Illinois at Chicago

**P2-B-4** Investigating proactive balance control in individuals with incomplete spinal cord injury

Presenter: Mackenzie Bone

Mackenzie Bone¹, Kristin Musselman¹, Joel Lanovaz¹, Tarun Arora¹, Gary Linassi³, Alison Oates¹

¹University of Saskatchewan, ²University of Toronto, ³Cleveland Clinic Foundation, ⁴Saskatchewan Health Authority

**P2-B-5** Locomotor savings of split-belt gait adaptation indicate long-term adaptation processes

Presenter: Tom Buurke

Tom Buurke¹, Claudine Lamoth¹, Lucas van der Woude¹, Rob den Otter¹

¹University Medical Center Groningen

**P2-B-6** Singular Spectrum Analysis for the detection of adaptation rates in split-belt data

Presenter: Rob den Otter

Rob den Otter¹, Tom Buurke¹, Claudine Lamoth¹

¹University Medical Center Groningen

**P2-B-7** Implicit and explicit motor learning in gait rehabilitation of people after stroke: A randomized controlled single blind trial

Presenter: Li-Juan Jie

Li-Juan Jie¹, Melanie Kleyner¹, Kenneth Meijer¹, Anne Beurskens², Susy Braun³

¹Maastricht University, ²Goud University of Applied Sciences

**P2-B-8** Hands up in the air and wave them like you care: Effect of exposure on upper limb kinematics during continuous, multi-directional perturbations

Presenter: Vicki Komisar

Carolyn Duncan¹, Alison Schinkel-Ivy², Andrew Laing³, Vicki Komisar⁴

¹University Medical Center of Freiburg, ²Manchester University, ³Curtin University, ⁴University of Waterloo

**P2-B-9** Neuromuscular adaptations in balance control following a lower-limb transfemoral amputation

Presenter: Cristian Pasluosta

Cristian Pasluosta¹, Claudia Ramos Claret², Georg Herget¹, Lukas Koubal¹, Daniel Wiest¹, Jochen Adler¹, Vinzenz von Tscharner⁴, Thomas Stiegitz⁴

¹Friedrich-Alexander University (FAU) Erlangen-Nürnberg, ²Zuyd University, ³Simon Fraser University, ⁴University of Calgary

**P2-B-10** Developing resilience to unpredictable body balance perturbations: Contextual interference effect in the training of compensatory arm and leg movements

Presenter: Luis Teixeira

Luis Teixeira¹, Patricia Takazono¹, Marina Betelli¹, Caroline Souza¹, Julia Oliveira¹, Daniel Coelho¹, Jacques Duysens²

¹University of São Paulo, ²Catholic University of Leuven

---

**C - Aging**

**P2-C-12** Cognitive-motor interference in older adults while navigating in an ecological environment

Presenter: Catherine Agathos

Catherine Agathos¹, Marcia Bégu³, Konogan Baranton², Delphine Bernheim², Angelo Arleo¹

¹Sorbonne Université, INSERM, CNRS, Institut de la Vision, ²École Internationale, ³Étudiant Canada

**P2-C-13** Parkinsonian gait in aging: A signature of Alzheimer’s pathology

Presenter: Gilles Allali

Gilles Allali¹, Eric Morel², Stephane Armand³, Frederic Assal¹

¹Geneva University Hospitals, ²University of Geneva, ³University of Salford

**P2-C-14** Effect of High Intensity Interval Training combined with citrulline supplementation on gait parameters and its predictors in healthy older women: A pilot study

Presenter: Mylene Aubertin

Mylene Aubertin-Leheudre¹

¹Université du Québec à Montréal
2019 ISPGR WORLD CONGRESS

P2-C-15 Rate of muscle force development during fatigue: Impact of age
Presenter: Marc Belanger
Marc Belanger¹, Charlotte Pion¹, Justine Lai¹, Said Mamouh², Mylene Aubertin-Leheudre³
¹Université de Montréal, ²University of Laval, ³National Institute of Research in Rehabilitation

P2-C-16 Can years of education predict gait speed? A cross-sectional study of community-dwelling Brazilian older adults
Presenter: Renato Freire Júnior
Renato Freire Júnior¹, Jaqueline Porto¹, Julia Fernandes¹, Larissa Bocarde², Tatiane Pontes³, Karoliny Cruz⁴, Juliane Belem⁵, Daniela Abreu⁶
¹University of São Paulo, ²Federal University of Amazonas - UFAM, ³Family Health Support Center - Coari - AM

P2-C-17 Is trunk strength associated with functional mobility in older women?
Presenter: Emily Gregg
Emily Gregg⁷, Gareth Nicholson⁸, Clive Beggs⁹, Athanasios Bissas¹⁰
Leeds Beckett University

P2-C-18 Which lower limb muscle strength could be associated with low gait speed in frail older people?
Presenter: Daniela Cristina Abreu
Daniela Cristina Abreu¹, Natalia Iosimuta², Natalia Alves³, Emanuela Angelini³, Fernanda Pessanha⁴, Larissa Marques⁵, Renato Freire Júnior⁶, Eduardo Ferriolli⁷, Daniela Abreu⁸
¹Federal University of Amazonas, ²Bento Ribeiro Para Medical School, University of São Paulo, ³Federal University of Manaus, ⁴University of São Paulo, ⁵Federal University of Amapa, ⁶Federal University of Manaus, ⁷University of São Paulo

P2-C-19 Spatiotemporal gait parameters for older adults - An interactive model adjusting reference data for gender, age, and body height
Presenter: Rolf Moe-Nilssen
Rolf Moe-Nilssen¹, Jorunn Helbostad²
¹University of Bergen, ²Norwegian University of Science and Technology

P2-C-20 The effects of fatigue and age on gait dynamics
Presenter: Paulo Cezar Rocha Santos
Paulo Cezar Santos¹, Tibor Hortobagyi², Inge Zijdewind³, Lilian Gobbi⁴, Fabio Barbieri⁵, Claudine Lamoth⁶
¹São Paulo State University (UNESP), ²University of Groningen, University Medical Center Groningen, ³University Medical Center Groningen

P2-C-21 Age-related differences in the energy cost of walking while thinking
Presenter: Britney Williams
Britney Williams¹, Taylor Woods¹, James Lang², Jessie Vanswearingen³, Kristin Lowry⁴
¹Des Moines University, ²Iowa State University, ³University of Pittsburgh

P2-C-22 Effects of age-related changes in step length and step width on the friction requirement at shoe-floor interface during straight level walking
Presenter: Takeshi Yamaguchi
Takeshi Yamaguchi¹, Kei Masani²
¹Tokushima University, ²University of Toronto

P2-C-23 Neurological mechanisms of balance and gait adaptations after downslope walking
Presenter: Nikki Atcheson-Huehn
Nikki Atcheson-Huehn¹, Jayne Kalmar², Michael Cinelli³
¹Wilfrid Laurier University

P2-C-24 Elucidation of the trunk motion affecting the knee joint stress during gait
Presenter: Masahiro Edo
Masahiro Edo¹, Fumiko Kamijo², Toshihiko Sato³
¹Oba Prefectural University of Health Sciences, ²Shiga University, ³Bunkyo Gakuin University

P2-C-25 Effect of trunk brace on forward bending movement characteristics in patients with scoliosis
Presenter: Wei-Chun Hsu
Wei-Chun Hsu¹, Muhammad Izhar Ahmed², Chao-Chin Chang³, Chi Kuang Feng⁴, Shi-Jinn Horg⁴, Chung-Hsien Kuo⁵, Shang-Chih Lin⁶
¹National Taiwan University of Science and Technology, ²Taipei Veterans General Hospital, National Yang Ming University, ³National Defense of Medial Center

P2-C-26 Relationship between foot posture assessment techniques and dynamic plantar pressure variables
Presenter: Muge Kirmizi
Muge Kirmizi¹, Mehmet Kacirolu², Ibrahim Simsek³, Sahil Angin⁴
¹Dokuz Eylul University

P2-C-27 Lateral stability during anterior and posterior support surface perturbations in people with chronic stroke
Presenter: Christopher McCrum
Christopher McCrum¹, Andrew Huntley², Alison Schinkel-Ivy³, Avril Mansfield⁴
¹University of Michigan, ²Toronto Rehabilitation Institute, ³Wellness Centre, ⁴Deakin University, Australia

P2-C-28 Using induced acceleration to study the effects of age and grade on the joint moment strategy to control knee flexion during weight acceptance in walking
Presenter: Jeroen Waanders
Jeroen Waanders¹, Tibor Hortobagyi², Alessio Murgia³, Paul DeVita⁴, Jason Franz⁵
¹University of Groningen, University Medical Center Groningen, ²University of North Carolina at Chapel Hill and North Carolina State University

P2-C-29 Are there associations between prefrontal cortex activity and turning behaviors in people with and without freezing of gait?
Presenter: Valeria Belluscio
Valeria Belluscio¹, Samuel Stuart², Elena Bergamini³, Giuseppe Vannozzi⁴, Martina Mancini⁵
¹University of Rome Foro Italico, ²Oregon Health & Science University

P2-C-30 Validation of divergent neural dysfunction in idiopathic REM sleep behaviour disorder patients separated using clinical phenotyping
Presenter: Kaylena Ehogetz Martens
Kaylena Ehogetz Martens¹, Elie Matar², James Shine³, Joseph Phillips⁴, Ronald Grunstein⁵, Glenda Halliday⁶, Simon Lewis⁷
¹University of Sydney, ²University of Western Sydney

P2-C-31 Prefrontal cortex activity requirements when young and older people perform cognitively-demanding stepping tasks in supported and unsupported conditions: A fNIRS study
Presenter: Jasmine Menant
Jasmine Menant¹, Paulo Pelicioni¹, Daina Sturniek¹, Stephene Lord²
¹Neuroscience Research Australia, University of New South Wales

P2-C-32 Exploration of brain cholinergic correlates of gait in Parkinson disease: An in vivo voxel-based [18F] FEDBV PET analysis
Presenter: Martijn Muller
Martijn Muller¹, Prabesh Kanel², Nielsa Boehnenn³
¹University of Michigan, ²University of Michigan, ³University of Michigan, ²University of Michigan, ³University of Michigan

P2-C-33 Brain activation associated with active and passive overground gait in a robotic exoskeleton
Presenter: Sue Peters
Sue Peters¹, Denis Louie¹, Shannon Lim¹, Chieh-ling Yang¹, Janice Eng¹
¹University of British Columbia

P2-C-34 Auditory-evoked cortical activity preceding postural instability
Presenter: Paula Polastri
Paula Polastri¹, Mark Laylor², Jessy Varghese³, William McIlroy²
¹São Paulo State University (UNESP), ²University of Waterloo

P2-C-35 Brain functional substrate of gait observation in Parkinson’s disease
Presenter: Martina Putzolo
Martina Putzolo¹, Giulia Bonmarito¹, Cecilia Cerulli¹, Giovanna Lagravinese², Carla Ogilastro², Gaia Bonassi¹, Laura Avanzino¹, Matilde Inglese¹, Elisa Pelosi¹
¹University of Genoa
POSTER SESSION INFO

P2-E-36  Higher resting state connectivity of the dopaminergic motor network may reduce age-related step length variability
Presenter: Rosana Zanella
Caterina Zanella, Helmut Kusmiesz, Andrea Rosso, Vincenzo Fontana, Elena Cilè, Giuseppe Tandoneri, University of Naples Federico II, University of Pisa, University of Rome Tor Vergata, University of Verona

P2-F-40  Gait patterns and cognitive decline: A longitudinal population-based study
Presenter: Samuel Stuart
Samuel Stuart, Martina Mancini, Braggio Johnson, University of Michigan, Michigan Medicine, Department of Neurology, Center for Integrative Brain Research - Integrative Neuroscience (CIN) & MEG Center, Michigan State University, University of the Pacific, University of Minnesota - Twin Cities

P2-G-44  Cognitive, attentional, and emotional influences
Presenter: Adam Cocks
Adam Cocks, William Young, Toby Ellmers, Joseph McCarthy, Noel Kinrade, Brunel University

P2-F-41  Is free-living gait assessment a useful marker of cognitive impairment and dementia disease subtype?
Presenter: Riona Mc Ardle
Riona Mc Ardle, Brook Galna, Silvia Del Din, Alan Thomas, Lynn Rochester, Newcastle University, Institute of Neuroscience, Newcastle University

P2-H-54  Postural control following a sport-related concussion changes in response to continuous platform rotations
Presenter: Harry Bailey
Harry Bailey, Cameron Kirk, Richard Mills, Richard Foster, Liverpool John Moores University, Manchester Metropolitan University

P2-H-47  Factors associated with texting while walking performance across different environments
Presenter: Tal Krasovsky
Tal Krasovsky, Patrice Weiss, Rachel Kizony, University of Haifa

P2-H-53  The association of confidence in walking, fear of falling and cautious gait in older adults
Presenter: Maha Almarwani
Maha Almarwani, Jennifer Brach, Yonsei Saud University, University of Pittsburgh

P2-G-50  Relating reaction times to local sway features to unveil inter/intramyel judging in postural control
Presenter: John Stins
John Stins, Melvyn Roerdink, Vrije Universiteit Amsterdam

P2-H-55  Control of the trunk during walking: Early manifestations of antero-posterior angle changes
Presenter: Ioannis Bargiotas
Ioannis Bargiotas, Juan Mantilla, Danping Wang, Pierre-Paul Vidal, CNRS, SSA, University Paris Descartes, Paris IV

P2-F-42  Developing exercise groups for persons with dementia
Presenter: Kristin Taraldsen
Kristin Taraldsen, Elisabeth Boulton, Jordunn Helbostad, Ingvild Saltvedt, Gro Tangen, Randi Granbo, Norwegian University of Science and Technology, University of Manchester, Norwegian National Advisory Unit on Ageing and Health

P2-F-43  The effects of cognitive impairment on the multi-scale dynamics of standing postural control in older adults
Presenter: Junhong Zhou
Junhong Zhou, Brad Manor, J. Riley McCarten, Michael Wade, Azizah Jordan, Yvan-Andro Medical School, Minneapolis Veterans Affairs Medical Center, University of Minnesota - Twin Cities

Presenter: Nadia Polskaia
Nadia Polskaia, Rebecca Bond, Juliane Ratte, Yves Lajoie, University of Ottawa

P2-F-39  Influence of anxiety on prefrontal cortical activity during usual walking and obstacle crossing in older adults
Presenter: Rodrigo Vitório
Rodrigo Vitório, Nubia Conceição, Priscilla Sousa, Diego Orcioli-Silva, Victor Beretta, Ellen Lirani-Silva, Lilian Gobbi, Rodrigo Vitório, São Paulo State University (UNESP)

P2-G-48  Dual-task gait training is not superior to single-task gait training within 3 years of stroke: A randomized controlled trial
Presenter: Prudence Plummer
Prudence Plummer, Jody Feld, Lisa Zukowski, Bijan Najafi, University of North Carolina at Chapel Hill, High Point University

P2-G-47  Higher resting state connectivity of the dopaminergic motor network may reduce age-related step length variability
Presenter: Kristin Taraldsen
Kristin Taraldsen, Elisabeth Boulton, Jordunn Helbostad, Ingvild Saltvedt, Gro Tangen, Randi Granbo, Norwegian University of Science and Technology, University of Manchester, Norwegian National Advisory Unit on Ageing and Health

P2-G-46  Reading the mind: Pupillometry as a means to measure conscious movement processing?
Presenter: Ruth Stout
Ruth Stout, Lauren Higgins, Danielle Felsburg, Masahiro Yamada, Sean Cochrane, Chanel LoJacono, Amanda Barcliff, John Palazzolo, Jeff Labban, Louisa Raisbeck, Jeffery Fairbrother, Christopher Rhea, University of North Carolina, Greensboro, University of Tennessee

P2-G-45  The validity and predictive validity of the Gait-Specific Attentional Profile (G-SAP)
Presenter: Adam Cocks
Adam Cocks, William Young, Toby Ellmers, Joseph McCarthy, Noel Kinrade, Brunel University

P2-F-40  Postural adjustments during manual motor imagery in young and older people
Presenter: Chloe Wider
Chloe Wider, Mark Andrews, Hayley Boulton, Suvo Brata Mitra, Nottingham Trent University

F - Cognitive impairments
P2-F-40  Gait patterns and cognitive decline: A longitudinal population-based study
Presenter: Oshadi Jayakody
Oshadi Jayakody, Monique Breslin, Velandai Srikanth, Michele Cavallia, University of Tasmania, Peninsula Health, Monash University

P2-G-51  Smartphone-based balance assessment for older adults enrolled a 12-week attentionally focused balance training intervention: Preliminary data
Presenter: Ruth Stout
Ruth Stout, Lauren Higgins, Danielle Felsburg, Masahiro Yamada, Sean Cochrane, Chanel LoJacono, Amanda Barcliff, John Palazzolo, Jeff Labban, Louisa Raisbeck, Jeffery Fairbrother, Christopher Rhea, University of North Carolina, Greensboro, University of Tennessee

P2-G-48  Developing exercise groups for persons with dementia
Presenter: Kristin Taraldsen
Kristin Taraldsen, Elisabeth Boulton, Jordunn Helbostad, Ingvild Saltvedt, Gro Tangen, Randi Granbo, Norwegian University of Science and Technology, University of Manchester, Norwegian National Advisory Unit on Ageing and Health

P2-G-47  Factors associated with texting while walking performance across different environments
Presenter: Tal Krasovsky
Tal Krasovsky, Patrice Weiss, Rachel Kizony, University of Haifa

P2-G-46  Reading the mind: Pupillometry as a means to measure conscious movement processing?
Presenter: Ruth Stout
Ruth Stout, Lauren Higgins, Danielle Felsburg, Masahiro Yamada, Sean Cochrane, Chanel LoJacono, Amanda Barcliff, John Palazzolo, Jeff Labban, Louisa Raisbeck, Jeffery Fairbrother, Christopher Rhea, University of North Carolina, Greensboro, University of Tennessee

P2-G-45  Relating reaction times to local sway features to unveil inter/intramyel judging in postural control
Presenter: John Stins
John Stins, Melvyn Roerdink, Vrije Universiteit Amsterdam

P2-G-50  Postural adjustments during manual motor imagery in young and older people
Presenter: Chloe Wider
Chloe Wider, Mark Andrews, Hayley Boulton, Suvo Brata Mitra, Nottingham Trent University

H - Coordination of posture and gait
P2-H-53  The association of confidence in walking, fear of falling and cautious gait in older adults
Presenter: Maha Almarwani
Maha Almarwani, Jennifer Brach, Yonsei Saud University, University of Pittsburgh

P2-H-54  Postural control following a sport-related concussion changes in response to continuous platform rotations
Presenter: Harry Bailey
Harry Bailey, Cameron Kirk, Richard Mills, Richard Foster, Liverpool John Moores University, Manchester Metropolitan University

P2-H-55  Control of the trunk during walking: Early manifestations of antero-posterior angle changes
Presenter: Ioannis Bargiotas
Ioannis Bargiotas, Juan Mantilla, Danping Wang, Pierre-Paul Vidal, CNRS, SSA, University Paris Descartes, Paris IV

P2-H-56  Dual tasks during treadmill walking in a fully immersive virtual environment
Presenter: Lars Peder Bovim
Lars Peder Bovim, Beate Gjesdal, Silje Maeland, Bård Bogen, Western Norway University of Applied Sciences

P2-H-57  Beat perception and production abilities affect responsiveness of temporal gait asymmetry to rhythmic auditory stimulation following stroke
Presenter: Lucas Crosby
Lucas Crosby, Jennifer Wong, Jessica Grahn, Joyce Chen, Dina Brooks, Kara Patterson, University of Toronto, Toronto Rehabilitation Institute, Brain & Mind Institute - Western University

P2-H-58  Postural adjustments during manual motor imagery in young and older people
Presenter: Carolin Curtze
Carolin Curtze, University of Nebraska Omaha

2019 ISPGR WORLD CONGRESS | ToC 102 | www.ispgr.org | @ISPGR | JUNE 30 – JULY 4
P2-H-59 Head anticipation during auditory instructed locomotion
Presenter: Felix Dollack
Felix Dollack¹, Hideki Kadone¹, Monica Perusquia Hernandez², Kenji Suzuki³
¹University of Tsukuba

P2-H-60 The effect of changes in body weight on postural control in obese and non-obese adults: A pilot study
Presenter: Daniela Godoi
Daniela Godoi¹, Rafael Santi³
¹Federal University of São Carlos (UFSCar)

P2-H-61 Repetitive experience touching door edges with fingers while walking through an aperture to improve fine-tuning of collision-avoidance behavior
Presenter: Tomoki Hakamata
Tomoki Hakamata¹, Yoshibtsugu Kondo², Takahiro Higuchi³
¹Tokyo Metropolitan University, ²University of British Columbia, ³Department of Health Promotion Science, Tokyo Metropolitan University

P2-H-62 The influence of anxiety on motor strategy selection during a stepping down paradigm in older adults
Presenter: Nick Kluft
Nick Kluft², Sjoerd Bruijn¹, Jaap van Dieën¹, Mark Carpenter², Mirjam Pijnappels¹
¹Vrije Universiteit Amsterdam, ²University of Amsterdam, ³University of British Columbia

P2-H-63 Exploring the relationships between trunk sway, walking speed and gender
Presenter: Joel Lanovaz
Joel Lanovaz¹, Sahya Bhargava¹, Robert Downey¹, Alison Fedoruk¹, Logan Michalishen¹, Serena Saini¹, Alison Oates¹
¹Government University, ²Rehabilitation center “Russcoe Pole”, ³Dmitry Rogachev National Research Center of Hematologic, Oncology and Immunology

P2-H-55 Slower reactive turning while walking in older adults: An association with cognitive-motor function
Presenter: Takahito Nakamura
Takahito Nakamura¹, Takahiro Higuchi³, Touyou Kikumoto¹, Fumihiko Hoshî¹
¹Saitama Prefectural University, ²Tokyo Metropolitan University

P2-H-66 Feedforward and feedback control components in the generation of automatic postural responses
Presenter: Julia Oliveira
Nametala Azzi¹, Julia Oliveira¹, Daniel Coelho¹, Luis Teixeira¹
¹University of São Paulo

P2-H-67 Postural reactions and spinal excitability modulation during balance perturbation following incomplete spinal cord injury
Presenter: Charlotte Pion
Charlotte Pion¹, Mélisâa-St-Pierre Bolduc², Zoé Miranda², Maureen MacMahôn², Dorothy Barthélemy²
¹Université du Québec à Montréal, ²Université de Montréal, ³CIUSSS Centre-Sud-de-l’île-de-Montréal

P2-H-68 The effects of cognitive interference on gait and turning in Huntington’s disease
Presenter: Nicolette Purcell
Niccoline Purcell¹, Jennifer Goldman¹, Bryan Bernard², Joan O’Keefe³
¹Rush University Medical Center

P2-H-69 Sensory contributions to head and lumbar sway in healthy individuals and those with mild traumatic brain injury
Presenter: Tiphaine Raffegueau
Tiphaine Raffegueau¹, Mindie Clark¹, Lucy Parrington¹, Robert Peterka², James Chesnutt², Laurie King², Peter Fino³
¹University of Utah, ²Oregon Health & Science University

P2-H-70 Bridging the callosal gap in gait: A mechanistic evaluation of while matter’s role in bilateral coordination
Presenter: Sutton Richmond
Sutton Richmond¹, Clayton Swanson¹, Tyler Whittier¹, Daniel Peterson¹, Brett Fling¹
¹Colorado State University, ²Arizona State University

P2-H-71 The contribution of intralimb kinetic coordination in lower limb to control of propulsion and weight support at a wide range of gait speed in young and elderly people
Presenter: Yusuke Sekiguchi
Yusuke Sekiguchi¹, Dai Owaki¹, Keita Honda¹, Shin-ichi Izumi¹
¹Tokyo University

P2-H-72 Postural balance at children survived after posterior fossa tumor, acute lymphoblastic leukemia and hematopoietic stem cell transplantation
Presenter: Dmitry Skvortsov
Dmitry Skvortsov¹, Alexey Harshikov², Daria Zhuk², Vlad Nikulin³, Serafima Chechelnitskaya¹, Vladimir Kasatkin¹, Alexander Karelin³
¹Government University, ²Rehabilitation center “Russsoe Pole”, ³Dmitry Rogachev National Research Center of Pediatric Hematology, Oncology and Immunology

P2-H-73 Tandem Walking Test kinematics - A normal data
Presenter: Dmitry Skvortsov
Dmitry Skvortsov¹, Alina Aisenshtein¹, Vladimir Kasatkin¹, Anatoly Shipilov²
¹Government University, ²Rehabilitation center “Russsoe Pole”, ³Dmitry Rogachev National Research Center of Pediatric Hematology, Oncology and Immunology

P2-H-74 Postural adaptations in response to haptic forces during self-paced treadmill walking post-stroke
Presenter: Gianluca Sorrento
Gianluca Sorrento¹, Philippe Aïmbault², Joyce Fung³
¹Jewish Rehabilitation Hospital (CISSS-Laval), ²McGill University, ³Quebec University, "Ecole Polytechnique Fédérale de Lausanne (EPFL), Hospital Bicêtre" in Paris

P2-H-75 Fluctuation of center of pressure and the affecting factors in young children
Presenter: Naomi Tsuchita
Naomi Tsuchita¹, Suyehi Kobayashi¹, Shino Ogawa¹, Taiko Shiva¹, Yasuko Funabiki¹
¹Kyoto University

P2-H-76 The role of vision in backward walking in adults with cerebral palsy
Presenter: Yui Sato
Yui Sato¹, Hideyuki Tashiro¹, Naoki Kozuka¹
¹Sapporo Medical University

P2-H-79 Mechanical consequences of trunk flexion on slopes during human walking
Presenter: Amy Wu
Amy Wu¹, Salman Faraji¹, Christopher Easthope³, Auke Jipspeert³
¹Queen’s University, ²Ecole Polytechnique Fédérale de Lausanne (EPFL), ³University Hospital Balgrist

I - Development of posture and gait

P2-I-81 Characteristics of postural adjustments in sitting reach task in adults with cerebral palsy
Presenter: Yui Sato
Yui Sato¹, Hideyuki Tashiro¹, Naoki Kozuka¹
¹Sapporo Medical University

P2-I-82 Balance recovery following mediolateral pelvis perturbations during slow walking
Presenter: Michelle van Mierlo
Michelle van Mierlo¹, Boris Ruwe¹, Mark Vlutters¹, Edwin H. F. van Asseldonk¹, Herman van der Kooij¹, University of Twente

Ijspeert², Amy Wu¹, Salman Faraji¹, Christopher Easthope³, Auke Jipspeert³
¹Queen’s University, ²Ecole Polytechnique Fédérale de Lausanne (EPFL), ³University Hospital Balgrist
P2-K-83 Reproducibility of the Timed Up and Go (TUG) standard and dual task versions in school-aged children with and without coordination difficulties
Presenter: Leanne M Johnston
Leanne Johnston¹, Breanna Raatz², Gemma Allinson², Rosalee Dewar¹, Sally Hannah¹
¹University of Queensland

P2-K-84 Will my child walk? New insights into the relationship between lower limb muscle strength and gross motor function in children with spina bifida myelomeningocele
Presenter: Leanne Johnston
Leanne Johnston¹, Ashleigh Gehrig¹, Nicole Thomas³, ¹University of Queensland, ²Children’s Health Queensland Hospital & Health Service

P2-J-85 A retrospective study toward characterizing the long-term effects of single-event multilevel surgery on gait consistency in children with spastic bilateral cerebral palsy
Presenter: Rosa Visscher
Rosa Visscher¹, Nadine Hasler¹, Marie Fesslier¹, Navrag Singh¹, Reinald Brunner², Erich Rutz³
¹ETH Zurich, ²University Children’s Hospital Basel

P2-J-86 Functional gait in children with developmental coordination disorder compared to typically developing children
Presenter: Vivian Weerdesteyn
Rosanne Kuipers¹, Ellen Smulders¹, Vivian Weerdesteyn¹
¹Radboud University Medical Center

K - Devices to improve posture and gait

P2-K-87 Non-invasive spinal cord stimulation for the treatment of motor symptoms of Parkinson’s disease
Presenter: Maria Alamos
Maria Alamos¹, Aiqules Martinez², Carlos Juri¹, Rómulo Fuentes³
¹Pontificia Universidad Catolica de Chile, ²Universidad de Chile, ³Universidad de Chile
N - Falls and fall prevention

P2-N-104 A novel multivariate approach to characterise stair-negotiating behaviour and detect fall risk in older adults
Presenter: Thijs Ackermans
Thijis Ackermans¹, Natasha Franckens¹, Raoul Casana-Eslava¹, Carolyn Lees², Vasilios Baltzopoulos², Paulo Lisboa³, Mark Hollands¹, Thomas O’Brien¹, Constantinos Maganaris¹
Liverpool John Moores University

P2-N-105 Walking for better outcomes and recovery: The effect of WALK-FOR in preventing hospital-associated functional decline among older adults
Presenter: Maayan Agmon
Maayan Agmon¹, Anna Zisberg¹, Yaniv Cohen¹, Efrat Gil², Yehudith Chayat³, Chedva Levin³, Nurit Gur-Yaish³, Debbi Rand⁴
¹University of Haifa, ²Clalit Health Services, Israel, ³ commonplace Medical Center, ⁴Tel-Aviv University

P2-N-106 Lateral loss of balance among one-time fallers and recurrent fallers reveals contrasted differences in step thresholds and spatiotemporal parameters compared to non-fallers
Presenter: Shani Batcir
Shani Batcir¹, Guy Shani¹, Amir Shapiro¹, Yoav Gimmon¹, Shani Batcir
¹University of Haifa, ²Clalit Health Services, Israel, ³Hemek Medical Center, ⁴Tel-Aviv University

P2-N-107 Falling down - limbs and trunk muscles responses to vertical perturbations
Presenter: Desiderio Cano Porras
Desiderio Cano Porras¹, Jesse Jacobs², Ashwini Kulkarni¹, Danielle Felsberg¹, Chanel Lojano³, Sean Cochran³, Amanda Barcliff³, John Palazzolo³, Jeff Labban³, Jeffrey Fairbrother³, Christopher Rhea³, Louise Raaisbeck³
¹University of North Carolina, Greensboro, ²University of Vermont, ³University of Michigan

P2-N-108 Falls and locomotor capabilities in lower limb amputees. First results of a retrospective study from the MOTO project
Presenter: Lorenzo Chiari
Lorenzo Chiari¹, Serena Moscato¹, Pericle Randi², Luca Palmieri¹, Angelo Davalli¹, Pierpaolo Palumbo¹
¹Alma Mater Studiorum - Universita' di Bologna, ²INAIL Prosthesis Centre

P2-N-109 Measuring foot clearance on outdoor walkways
Presenter: Ghazaleh Delfi
Ghazaleh Delfi¹, Megan Kamachi², Jose Beltran³, Tilk Dutta¹
¹Toronto Rehabilitation Institute / University of Toronto, ²Toronto Rehabilitation Institute

P2-N-110 Wearable sensor detection of real-world trips in at-risk fall community dwelling older adults
Presenter: Shirley Handelzalts
Shirley Handelzalts¹, Neil Alexander², Linda Nyquist², Debra Strasburg³, Nicholas Mastrusserio³, Lauro Ojeda³
¹University of Michigan

P2-N-111 Static balance following a 12-week attentionally focused balance training intervention: Preliminary data
Presenter: Lauren Higgins
Lauren Higgins¹, Masa Yamada¹, Ruth Stout¹, Danielle Felsberg¹, Chanel Lojano³, Sean Cochran³, Amanda Barcliff¹, John Palazzolo¹, Jeff Labban¹, Jeffrey Fairbrother³, Christopher Rhea³, Louise Raaisbeck³
¹University of North Carolina, Greensboro, ²University of Vermont, ³University of Michigan

P2-N-112 Joint angle variance in the bipedal linked chain during chair negotiation
Presenter: Ashwini Kulkarni
Ashwini Kulkarni¹, HyeYoung Cho¹, Chuyi Cui¹, Shirley Rietdyk¹, Satyajit Ambike¹, Fabio Barbieri¹
¹Purdue University, ²São Paulo State University (UNESP)

P2-N-113 Functional Gait Assessment (FGA) after a 12-week attentionally focused balance training intervention: Preliminary data
Presenter: Daniille Felsberg
Daniille Felsberg¹, Lauren Higgins¹, Ruth Stout¹, Masahiro Yamada¹, Sean Cochran¹, Chanel Lojano³, Amanda Barcliff¹, John Palazzolo¹, Jeff Labban¹, Jeffrey Fairbrother³, Christopher Rhea³, Louise Raaisbeck³
¹University of North Carolina, Greensboro, ²University of Vermont, ³University of Michigan

P2-N-114 Failing for: The effects of anxiety on balance control
Presenter: Anna Fielding
Anna Fielding¹, Will Young¹, Andrew Parton¹
¹Brunel University

P2-N-115 Effects of step direction and stimulus modality on step reactions during a prolonged motor-cognitive task in older adults
Presenter: Eleftheria Giannouli
Eleftheria Giannouli¹, Wiebren Zijlstra³
¹German Sport University Cologne, ²University of Salford, ³University of British Columbia

P2-N-116 Association of walk ratio during normal gait speed and fall in community-dwelling elderly people
Presenter: Sho Nakakubo
Sho Nakakubo¹, Takehiko Doi¹, Kota Tsutsumimoto¹, Min-Ji Kim¹, Satoshi Kurita¹, Hideaki Ishii¹, Hiroyuki Shimada¹
¹University of Nagoya, ²National Center for Geriatrics and Gerontology

P2-N-117 Validating the rate of perceived stability scale to measure balance training intensity among older adults
Presenter: Ann Reinhart
M Ann Reinhart¹, Debbie Espy¹, Lorenzo Bianco¹, Kathryn Krozewickz¹
¹Cleveland State University

P2-N-118 Transfer and retention effects of perturbation-based treadmill training in older adults
Presenter: Markus Rieger
Markus Rieger¹, Selma Papegaaij², Mirjam Pijnappels¹, Frans Steenbrink¹, Jaap van Dieën¹
¹Vrije Universiteit Amsterdam, ²Moteck Medical BV

P2-N-119 Elderly fallers and non-fallers adjust their posture in anticipation of perturbations
Presenter: Thomas Robert
Thomas Robert¹, Charlotte Le Mouel⁵, Romain Tisserand⁶, Romain Brette⁷
¹Université de Lyon, ²Max Planck Institute of Intelligent Systems, ³University of British Columbia, ⁴Surbonne Université, ⁵INSERM, ⁶CNRS, ⁷Institut de la Vision

P2-N-120 The influence of fear priming on whole-body reaching in young and older adults
Presenter: Alexander Stamenkovic
Alexander Stamenkovic¹, Susanne van der Veen¹, James Thomas¹
¹Virginia Commonwealth University, ²Virginia Commonwealth University

P2-N-121 Fall risk and falls are related to spatiotemporal gait asymmetry in older adults: Effect of gait speed
Presenter: Brian Street
Brian Street¹
¹California State University, Bakersfield

P2-N-122 Lateral balance capacity after external perturbation in persons with chronic stroke
Presenter: Hideyuki Tashiro
Hideyuki Tashiro¹, Yui Sato¹, Naoki Kozuka¹
¹Sapporo Medical University

P2-N-123 Do falls precede or follow changes in self-efficacy scores regarding falls and gait in community-dwelling older adults?
Presenter: Roel Weijer
Roel Weijer¹, Marco Hoozemans¹, Jaap van Dieën¹, Mirjam Pijnappels¹
¹Vrije Universiteit Amsterdam

O - Habilitation & rehabilitation

P2-O-124 Mediolateral constraints during overhead unloading result in altered gait dynamics and balance regulation
Presenter: Christopher Easthope
Christopher Easthope¹, Niklas Ignasiak², Mathias Bannwart¹, Sara Bauer³, Armin Curt³, Georg Rauter³, Marc Bolliger¹
¹University Hospital Balgast, ²Chapman University, ³University Basel

P2-O-125 Immediate effects of Voluntary-induced Stepping Response (VSR) training on protective stepping in persons with chronic stroke: A randomized control trial
Presenter: Kristen Hollands
Kristen Hollands¹, Pornpoom Chayasit², Mark Hollands², Rumpa Boonsinsuk²
¹University of Salford, ²Sirirajkkhinwirot University, ³Liverpool John Moores University

POSTER SESSION INFO
P2-O-127  Effects of modified exercise programme for improving axial rigidity and turning dysfunction in individuals with Parkinson’s disease  
Presenter: Fuenga Khokhun  
Fuenga Khokhun¹, Mark Hollands², Amornpan Ajijampan²  
¹Liverpool John Moores University, ²Mahidol University

P2-O-128  Differences in lateral symmetry of muscle synergies between acute post-stroke patients undergoing robot-assisted therapy and conventional therapy  
Presenter: Chun Kwang Tan  
Chun Kwang Tan¹, Hideki Kadome¹, Hiroki Watanabe¹, Aki Marushima¹, Yasushi Hada¹, Masashi Yamazaki¹, Yoshiyuki Sankai², Kenji Suzuki¹  
¹University of Tsukuba

P2-Q-132  Parkinson’s disease delays predictable visual cue processing although it does not affect complex and non-predictable visual cue processing in postural control  
Presenter: José Barea  
José Barea¹, Caio Cruz², Flávia Doná³, Vitor Amaral³, Henrique Ferraz³, Ana Barea³  
¹São Paulo State University (UNESP), ²University of São Paulo, ³Federal University of São Carlos (UFSCar), ⁴Cruzeiro do Sul University

P2-Q-133  Impact of attentional abilities on step initiation in patients with Parkinson’s disease with and without freezing of gait  
Presenter: Madli Bayot  
Madli Bayot¹, Aurore Braquet¹, Céline Tard¹, Luc Defebvre¹, Kathy Dujardin², Arnaud Delval²  
¹University of Lille - Inserm U1171-Degenerative and Vascular Cognitive Disorders

P2-Q-134  Postural biomechanical predictors of subjective and objective measures of severity of freezing of gait in Parkinson’s disease  
Presenter: Daniel Coelho  
Daniel Coelho¹, Caroline Souza¹, Carla Silva-Batista¹, Andrea de Lima-Pardini¹, Alexandre Bastos², Luis Teixeira¹  
¹University of São Paulo, ²Federal University of ABC

P2-Q-135  Is mediolateral dynamic balance in Parkinson’s disease similar between freezers and non-freezers?  
Presenter: Bauke Dijkstra  
Bauke Dijkstra¹, Moran Gilat¹, L. Eduardo Cofré Lizama², Sabine Verschueren¹, Alice Nieuwboer¹  
¹KU Leuven, ²University of Tuebingen

P2-Q-136  Characterization of novel centre of pressure cyclogram measures during double support phase of gait in people with stroke  
Presenter: Sarah Gregor  
Sarah Gregor¹, Julie Vaughan-Graham², Kara Patterson¹  
¹University of Toronto, ²Toronto Rehabilitation Institute

P2-Q-137  Oxygenated hemoglobin concentration levels during usual walking and obstacle course in people with Parkinson’s Disease (PD)  
Presenter: Lilian Gobbi  
Lilian Gobbi¹, Diego Orcioli-Silva¹, Priscila Sousa², Nubia Conceição³, Victor Beretta¹, Ellen Lirani-Silva¹, Rodrigo Vítor³  
¹São Paulo State University (UNESP)

P2-Q-138  Influence of ankle-foot orthosis with different type of joint on walking parameters in stroke patients  
Presenter: Naruhito Hasui  
Naruhito Hasui¹, Naomichi Mizuta¹, Yasutaka Higa³, Yasutada Yamamoto³, Ayaka Matsunaga¹, Tomoki Nakatan¹, Masako Tsutsumi¹, Junji Taguchi¹, Yohei Okada³  
¹Department of Neurorehabilitation, Graduate School of Health Sciences, Kio University, ²Tokarazuka Rehabilitation Hospital, ³University of Kio

P2-Q-140  Can quantitative gait parameters serve as progression marker of Parkinson’s disease? A longitudinal study over 5 years  
Presenter: Markus Hobert  
Markus Hobert¹, Susanne Nussbaum², Tanja Heger¹, Daniela Berg¹, Walter Maetzler⁴, Sebastian Heinzel³  
¹Christian-Albrechts-University of Kiel, ²University of Tuebingen

P2-Q-141  What can EMG tell us about the neuromotor control of gait in Parkinson’s disease?  
Presenter: Aisha Islam  
Aisha Islam¹, Lisa Alcock¹, Kianoush Nazarpour¹, Lynn Rochester¹, Annette Pantall²  
¹University College London, ²Imperial College London

P2-Q-142  Split-Belt Treadmill walking in people with Parkinson’s disease: A systematic review  
Presenter: Seuthe Jana  
Jana Seuthe¹, Nicholas D’Cruz², Pieter Ginis³, Burkhard Weisser¹, Daniela Berg¹, Günter Deuschl¹, Alice Nieuwboer², Christian Schlenstedt³  
¹Christian-Albrechts-University of Kiel, ²University Hospital Schleswig Holstein, Christian-Albrechts-University Kiel

P2-Q-143  Functional gait disorders and the broken escalator phenomenon  
Presenter: Diego Kaski  
Diego Kaski¹, Denise Lin², Akila Ramamoorthy³, Patricia Castro⁴, Amy Edwards³, Jan Coobergh¹, Mark Edwards⁴, Adolfo Bronstein³  
¹University College London, ²Imperial College London, ³St George’s Hospital

P2-Q-144  Central cholinergic activity and risk of falls in patients with Parkinson’s disease and freezing of gait  
Presenter: Giovanni Lagravinese  
Giovanni Lagravinese¹, Gaia Bonassi¹, Martina Putzolu¹, Alessandro Botta¹, Carola Cosentino¹, Anat Mirelman¹, Elisa Pelosi¹, Laura Avanzino¹  
¹University of Genoa, ²Tel-Aviv Sourasky Medical Center

P2-Q-145  Why do asymmetric gait patterns persist after deep brain stimulation in Parkinson’s disease?  
Presenter: Deepak Ravi  
Deepak Ravi¹, Michelle Gowder¹, Niklas Ignasiak¹, Christian Baumann¹, Mechtild Uhl¹, William Taylor¹, Navrag Singh¹  
¹ETH Zurich, ²Chapman University, ³University Hospital Zurich

P2-Q-146  The effect of closed-loop tactile feedback on gait initiation in people with Parkinson’s disease with freezing of Gait  
Presenter: Christian Schlenstedt  
Christian Schlenstedt¹, Daniel Peterson², Martina Mancini³  
¹Christian-Albrechts-University of Kiel, ²Arizona State University, ³Oregon Health & Science University

P2-Q-147  Clinical meaningful thresholds of temporal and spatial gait parameters in the context of the differential diagnosis in gait ataxia  
Presenter: Roman Schniepp  
Roman Schniepp¹, Max Wuehr¹, Julian Decker¹  
¹Ludwig-Maximilians Universität München
P2-Q-148  Quantity and quality of gait in PD, MS and healthy people in a community setting
Presenter: Vrutangkumar Shah
Vrutangkumar Shah1, James McNaught2, Patricia Carlson-Kuhta3, Rebecca Spain4, John Nutt5, Mahmoud El Gohary6, Fay Horak7, Carolin Curz2
1Oregon Health & Science University, 2Portland State University, 3APDM, 4University of Nebraska Omaha

P2-Q-149  Antero-posterior foot placement is disturbed in people with Parkinson's disease: Preliminary data
Presenter: Lucas Simieli
Lucas Simieli1, Sjoerd Bruijn2, Erwin E van Wegen3, Fabio Barbieri1, Jaap van Dieën2
1São Paulo State University (UNESP), 2Vrije Universiteit Amsterdam, 3Amsterdam University Medisch Centrum

P2-Q-150  Predictors of subjective and objective measures of severity of freezing of gait in Parkinson's disease
Presenter: Caroline Souza
Caroline Souza1, Acacio Neto1, Daniel Coelho1, Andrea Lima-Pardini1, Raquel Marquesini1, Alana Batista1, Egberto Barbosa1, Carlos Ugrinowitsch1, Luis Teixeira1, Carla Silva-Batista1
1University of São Paulo, 2Federal University of ABC

P2-Q-151  Natural progression of gait impairment in early Parkinson's disease: A six-year prospective incident cohort study
Presenter: Joanna Wilson
Joanna Wilson1, Alison Yarnall1, Sue Lord2, Lisa Alcock1, Shauna Holland1, Rosie Morris2, Sue Lord3, Brook Galna1, Lynn Rochester4
1Newcastle University, 2Oregon Health & Science University, 3Rutland University of Technology, 4Institute of Neuroscience, Newcastle University

P2-Q-153  Frailty status predicts falls in early Parkinson's disease
Presenter: Alison Yarnall
Alison Yarnall1, Shauna Holland1, Rosie Morris3, Sue Lord1, Brook Galna1, Lynn Rochester4
1Newcastle University, 2Oregon Health & Science University, 3Rutland University of Technology, 4Institute of Neuroscience, Newcastle University

P2-R-154  Collegiate athletes with a conservative gait strategy are more likely to sustain a lower extremity musculoskeletal injury following concussion
Presenter: Jessie Oldham
Jessie Oldham1, David Howell2, Christopher Knight1, Jeremy Crenshaw2, Thomas Buckley1
1Boston Children’s Hospital, 2Children’s Hospital Colorado, 3University of Delaware

T - Psychiatric disorders
P2-T-155  Short postural training affects stability in children with autism spectrum disorders
Presenter: Simona Caldani
Simona Caldani1, Maud Tsine1, Paola Atzori2, Hugo Peyre1, Richard Delorme3, Maria Pia Bucco1
1Hospital Robert Detré, 2Institute Jozef Stefan, 3Institute of Neuroscience, Newcastle University

U - Robotics
P2-U-156  Bilateral reshaping of gait coordination in hemiparetic stroke patients after early robotic intervention
Presenter: Sandra Puentes
Sandra Puentes1, Hideki Kadone1, Hiroki Watanabe1, Yasushi Hada2, Tomoyuki Ueno2, Aiki Marushima3, Yoshiyuki Sankai1, Kenji Suzuki2
1University of Tsukuba, 2Faculty of Medicine, 3Institute of Neuroscience, University of Tsukuba Hospital

V - Sensorimotor control
P2-V-157  Effects of ankle muscle fatigue and visual behavior on postural sway in young adults
Presenter: Fabio Barbieri
Fabio Barbieri2, Tiago Penedo1, Lucas Simieli1, Ricardo Barbieri2, Alessandro Zagatto1, Jaap van Dieën5, Mirjam Pijnappels1, Sérgio Rodrigues1, Paula Polet3, Mirjam Pijnappels2, 1São Paulo State University (UNESP), 2Graduate Program in Physical Education and Sport at School of Physical Education and Sport of Ribeirão Preto, 3Vrije Universiteit Amsterdam

P2-V-158  Lightly gripping a motionless handle: Study of postural sway decrease and correlation between transient force changes applied to the handle and balance
Presenter: Angéline Bellicha
Angéline Bellicha1, Andrés Trujillo-León1, Wael Bachta1
1Sorbonne Université - INSA

P2-V-159  Dynamic reweighting of three modalities for sensor fusion after repetitive head impact
Presenter: Jaclyn Caccese
Jaclyn Caccese1, Fernando dos Santos1, John Jeka1
1University of Delaware

P2-V-160  Threat-related changes in postural control in virtual environments
Presenter: Jernei Camennik
Jernei Camennik1, Sanja Kezić2, Jan Babić1
1Institute Jozef Stefan, 2Jozef Stefan Institute

P2-V-161  The effects of lighting level on balance in dancers
Presenter: Elizabeth Coker
Elizabeth Coker1, Terry Kaminski1
1NYU/Tisch School of the Arts, 2Teachers College of Columbia University

P2-V-162  Gender and form of thin plantar retrocapital metatarsal bar stimulations influence on postural control
Presenter: Marc Janin
Marc Janin1
1Université de Pau et des pays Léonard & Podiatrist office Poitiers

P2-V-163  The role of the vestibular system in the preparation of arm movements
Presenter: Michael Kennefick
Michael Kennefick1, Joel Burma2, Paige Copeland2, Paul van Donkelaar1, Chris McNeill1, Brian Dalton1
1University of British Columbia Okanagan, 2University of Sao Paulo

P2-V-164  Support Surface Translation - Sway responses of vestibular able subjects resemble those of vestibular loss subjects
Presenter: Thomas Mergner
Thomas Mergner1, Emre Akcay2, Vittorio Lippi3, Lorenz Assländer3
1Neurological University Clinics, Freiburg, 2Kocaeli University, 3University of Konstanz

P2-V-165  The effects of remote subthreshold stimulation on skin sensitivity in the lower extremity
Presenter: Emma Plater
Emma Plater1, Ryan Peters2, Leah Bent3
1University of Guelph, 2University of Calgary

P2-V-166  Electrocutaneous dynamics related to ankle proprioception reweighting
Presenter: Martin Simoneau
Martin Simoneau1, Catherine Bluteau1, Antoïl Noémie1
1Université Laval

P2-V-167  Collision avoidance between two walkers: Reduced avoidance behaviour in previously concussed athletes
Presenter: Natalie Snyder
Natalie Snyder1, Michael Cinelli2, Victoria Rapos3, Armel Crétau2, Anne-Hélène Olivier2
1Wilfrid Laurier University, 2University of Rennes / Inria

P2-V-168  Virtual time-to-contact indicates deficits in state prediction in women with multiple sclerosis
Presenter: Tyler Whittier
Tyler Whittier1, Sutton Richmond2, Andrew Monaghan3, Clayton Swanson3, Brett Fling4
1University of Colorado State University

W - Tools and methods for posture and gait analysis
P2-W-169  Test-retest reliability of frequency-domain measures of balance among people with sub-acute stroke
Presenter: Raabea Aryan
Raabea Aryan1, Andrew Huntley2, Elizabeth Inness3, Kara Patterson4, Avril Mansfield5
1University of Toronto, 2Toronto Rehabilitation Institute
P2-W-170  Evaluation of gait in the non-rigid XoSoft exo-skeleton in stroke and SCI patients
Presenter: Chris Baten
Chris Baten¹, Corien Nikamp¹, Leendert Schaake¹, Jaap Buurke¹
¹Rheong Research and Development

P2-W-171  Development of a clinical scale to assess retropulsion in neurological disorders
Presenter: Jeaninne Bergmann
Jeaninne Bergmann¹, Carmen Krewe¹, Eberhard Koenig¹, Friedemann Müller², Klaus Jahn²
²Schön Klinik Bad Aibling, Ludwig-Maximilians-Universitat München

P2-W-172  The inter relations between arm-leg, arm-arm and leg-leg coordination during human walking
Presenter: Maya Cohen
Maya Cohen¹, Uri Rosenblum², Desiderio Cano Porras¹, Oran Ben Gal², Meir Plotnik³
¹Sheba Medical Center, ²Center for the Study of Movement, Cognition and Mobility, Neurological Institute, Tel Aviv Sourasky

P2-W-173  Gait analysis by the use of handy three-dimensional acceleration sensors
Presenter: Kazuo Ishikawa
Kazuo Ishikawa¹, Aya Asari¹, Hiromoto Kimura³
³Japanese Red Cross Akita Hospital

P2-W-174  Development and content validity of a scale assessing lateropulsion in stroke patients: The SCALA
Presenter: Dominic Pérennou
Dominic Pérennou¹, Anais Odin², Emmanuelle Clarac³, Andréa Kistner², Shenhao Dai², Maud Barbado², Emilie Chipon², Carole Vuillerot², Jean-Luc Bosson², Alexandre Moreau-Gaudry⁴, Céline Piscicelli⁴
¹University Hospital Grenoble-Alpes, ²Grenoble Alpes University Hospitals, ³Chu Grenoble Alpes, ⁴University of Grenoble Alpes, ⁵University of Science and Technology Trondheim, ⁶Vrije Universiteit Amsterdam

P2-W-175  Impact of a thin plantar orthopaedic insert on posture and locomotion
Presenter: Carole Puhl
Carole Puhl², Anne Hélène Olivier², Armel Crétual²
²Université - IFPE-K - M2S Laboratory, ¹University of Rennes / Inria

P2-W-176  The association between physical capacity, physical performance, and fall risk in patients with Parkinson's disease
Presenter: Katharina Gordt
Katharina Gordt¹, Anisaoara Parascchiv-Ionescu², Anna Mikolajak³, Kristin Tårlåden⁴, Sabato Mellen³, Ronny Bergquist⁵, Jeanine Van Ancum⁶, Corinna Nerz⁷, Miriam Pijnappels⁸, Andrea Maien⁹, Jorunn Helbostad⁹, Beatrix Vereijken¹⁰, Clemens Becker¹⁰, Kamiar Am
⁰Network Aging Research, ¹Ecole Polytechnique Federale de Lausanne (EPFL), ²Robert-Bosch-Krankenhaus, ³Norwegian University of Science and Technology Trondheim, ⁴University of Bologna, ⁵Niwe Universiteit Amsterdam

P2-W-177  Gait analysis during the instrumented 6-minute walk test among older adults
Presenter: Shirley Shema Shiratzky
Shirley Shema Shiratzky¹, Eran Gazit¹, Ruopeng Sun¹, Keren Regev¹, Arnon Karni¹, Jacob Sosnoff², Anat Mirelman¹, Jeff Hausdorff³, Aron Buchanan¹
¹Tel-Aviv Sourasky Medical Center, ²Rush Alzheimer’s Disease Center, ³University of Illinois at Urbana-Champaign

P2-W-178  Preliminary evaluation of a self-guided fall risk assessment tool for older adults
Presenter: Ruopeng Sun
Ruopeng Sun¹, Roberto Aldunate¹, Vignesh Paramathayalan¹, Rama Ratnam¹, Sanjiv Jain³, Daniel Morrow¹, Jacob Sosnoff⁴
¹University of Illinois at Urbana-Champaign, ²Robert-Bosch-Krankenhaus, ³Carle Foundation Hospital

X - Vestibular function and disorders

P2-X-182  Body spatial representation in unilateral vestibular patients: Evolution before and after surgery
Presenter: Liliane Borel
Liliane Borel¹, Mathilde Bachelard-Serra², Laurence Bernard-Demanze³, Jean-Pierre Lavielle³, Arnaud Say³, Jacques Honore³
³CHRP & As-Marseille Univ, ²Hôpital de la Conception, AP-HM, ¹Geneva University Hospitals, ²Université de Lille

P2-X-183  The effect of roll circular vection on the subjective postural horizontal
Presenter: Taylor Cleworth
Taylor Cleworth¹, John H. Allum², Emma Nielsen³, Mark Carpenter³
¹University of Waterloo, ²University of Basel Hospital, ³University of British Columbia

P2-X-184  Optimal treatment period for vestibular balance rehabilitation in patients with chronic unilateral vestibular dysfunction
Presenter: Yoshiaki Yamakana
Yoshiaki Yamakana¹
¹Nara Medical University

P2-X-185  Detecting alterations in head movements in individuals with vestibulopathy of varying etiology
Presenter: Brian Loyd
Lee Dibble¹, Brian Loyd¹, Annie Fangman¹, Janie Saver-Steger¹, Mark Lester⁴, Serena Paul⁴
¹University of Utah, ²Army-Baylor University, ³University of Sydney

P2-X-186  The effect of roll circular vection on the postural equilibrium of patients with vestibular dysfunction
Presenter: Toshiaki Yamanaka
Toshiaki Yamanaka¹
¹Nara Medical University

P2-X-187  Quantitative gait analysis of acoustic neuroma patients using portable accelerometer
Presenter: Koh Koizumi
Koh Koizumi¹, Kazuo Ishikawa²
¹Akita University, ²Japanese Red Cross Akita Hospital

P2-X-188  Phase- and speed-dependent modulation of vestibulo-ocular reflexes during walking
Presenter: Max Wühr
Max Wühr¹, Hakei Dietrich¹
¹Ludwig-Maximilians-Universitat München

Poster Session Info

2019 ISPGR World Congress
ToC 114
www.ispgr.org | @ISPGR | June 30 – July 4

2019 ISPGR World Congress
ToC 115
www.ispgr.org | @ISPGR | June 30 – July 4
POSTER SESSION 3: THURSDAY 4TH JULY

A - Activity monitoring

P3-A-1 Associations between laboratory-based assessments and daily physical activity in patients with Parkinson’s disease: Can one replace the other?
Presenter: Ira Galperin
Inbar Hillel¹, Ira Galperin¹, Silvia Del Din¹, Esther Bekkers¹, Alice Nieuwboer¹, Giovanni Abbruzzese⁵, Laura Avanzino¹, Freek Nieuwhof⁶, Bastiaan Bloem⁶, Lynn Rochester¹, Ugo Della Croce³, Andrea Cereatti⁶, Nir Giladi¹, Anat Mirelman¹, Jeff Hausdorff¹
¹Tel-Aviv Sourasky Medical Center, Tel-Aviv, ²Newcastle University, ³KU Leuven, ⁴University of Genova & IRCCS San Martino Teaching Hospital, ⁵University of Genoa, ⁶Radboud University Medical Center, ¹²Institute of Neuroscience, Newcastle University, ²University of Sассi & Interuniversity Centre of Bioengineering of the Human Neuromusculoskeletal system

P3-A-2 Comparison among PD, MS and healthy people between prescribed gait test and continuous monitoring of the Human Neuromusculoskeletal system
Presenter: Vera Kooiman¹
Vera Kooiman¹, Vivian Weerdesteyn¹, Helco van Cusumano¹, Mirjam Pijnappels¹, Carel Meskers⁴, Andrea Maier⁴, Robert Bosch Medical Foundation, ¹University of Auckland

B - Adaptation, learning, plasticity and compensation

P3-B-3 Examining neural plasticity for slip-perturbation training: An fMRI study
Presenter: Tanvi Bhatt
Tanvi Bhatt¹, Patel Prakrut¹, Shamali Dusane³, Sophie DelDonno², Scott Scott Langenecker¹
¹York University, ²University of Salford

P3-B-4 Modulation of H-reflex; Effect of age and surface stiffness
Presenter: Leila Alizadehsaravi
Leila Alizadehsaravi¹, Sjoerd Bruijn¹, Huub Maas¹, Jaap van Dieën¹
¹Vrije Universiteit Amsterdam

P3-B-5 After-effect magnitude predicts retention in split-belt gait adaptation
Presenter: Tom Buurke
Tom Buurke¹, Claudine Lamoth¹, Lucas van der Woude¹, Rob den Otter¹
¹University Medical Center Groningen

P3-B-6 Combined study of segmental movements and motion of the centre of mass during adaptation on a split-belt treadmill
Presenter: Luigi Catino
Luigi Catino¹, Chiara Diletta Malloggi², Luigi Tesio²
¹Università degli Studi di Milano, ²IRCSS Santa Lucia Foundation

P3-B-7 Perceptions of induced temporal gait asymmetry in healthy adults
Presenter: Lucas Crosby
Lucas Crosby¹, Jessica Grah¹, Joyce Chen¹, Kara Patterson¹
¹University of Toronto, ²Brain & Mind Institute - Western University

P3-B-8 Retention of entrained auditory fractal patterns during gait
Presenter: Vincenzo Di Bacco
Vincenzo Di Bacco¹, Jeevaka Kiriell¹, Kristen Hollands³, William Gage¹
¹York University, ²University of Salford

P3-B-9 A new approach using electrical muscle stimulation to elucidate sensorimotor adaptation in human postural control system
Presenter: Shota Hagio
Shota Hagio¹, Anvar Azat¹, Daichi Nozaki¹
¹University of Tokyo

P3-B-10 Cortical correlates of gait adaptation to walking with a transfemoral dummy prosthesis
Presenter: Vera Kooiman
Vera Kooiman¹, Vivian Weerdesteyn⁴, Helco van Keeken⁴, Natasha Maurit⁴, Teodoro Solís-Escalante⁴
¹Radboud University Medical Center, ²University of Groningen, Medical Center Leeuwarden

P3-B-11 Retention, savings and interlimb transfer of reactive gait adaptations in humans following unexpected perturbations
Presenter: Christoph McCrum
Christopher McCrum¹, Kikoars Karamanidis², Paul Willems³, Wiebren Zijlstra², Kenneth Meijer²
¹Maastricht University, ²London South Bank University, ³German Sport University Cologne

C - Aging

P3-C-13 Effect of postural training in age-related muscular degeneration subjects
Presenter: Hortense Chatard
Hortense Chatard¹, Laure Tepenier¹, Talal Beydoun⁴, Olivier Offret⁵, Sawsen Salah⁶, José-Alain Sahel⁶, Saddek Mohand-Saïd⁷, Maria Piaucci⁵
¹INSERM, ²Service de Neurologie, Assistance Publique-Hôpitaux de Paris, Paris Descartes University, ³Sorbonne University, Institut de la Vision, Centre Hospitalier National d’Ophthalmologue des Quinze-Vingts, ⁴Hôpital Robert Debré, ⁵Hôpital René-Ducros, ⁶CHU de Lyon, ⁷Department of Neurology, Assistance Publique-Hôpitaux de Paris, Paris Descartes University

P3-C-14 Normative data of turning parameters in a large cohort of older adults using wearable sensors a four-year longitudinal study
Presenter: Morad Eshehabi
Morad Eshehabi¹, Minh Pham¹, Clint Hansen¹, Elke Warmerdam¹, Susanne Nusbaum¹, Daniela Berg¹, Walter Maetzler¹
¹Christian-Albrechts-University of Kiel, ²University of Tuebingen

P3-C-15 Regional associations of grey matter volume with gait variability-the Tasmanian Study of Cognition and Gait
Presenter: Oshadi Jayakody
Oshadi Jayakody¹, Jeanine Van Ancum¹, Richard Beare², David Boulton³, Beatriz Vereijken¹, Chris Todd², Anisa Parascich-Ionescu³, Kamari Aminian³, Andrea Maier⁴, Mirjam Pijnappels⁵, Katharina Gordt¹, Juron Helbostad², Clemens Becker³, Robert Bosch Medical Foundation, ¹Neuroscience Research Australia, University of New South Wales, ²Mount Royal, ³Amsterdam UMC, ⁴Vrije Universiteit Amsterdam

P3-C-16 Healthy older adults regulate lateral stepping in destabilizing environments
Presenter: Jonathan Dingwell
Jonathan Dingwell¹, Meghan Kazanski¹, Joseph Cusumano¹
¹Pennsylvania State University

P3-C-17 Do falls or fragility predict fracture in Māori and non-Māori in advanced age; LiLACS NZ
Presenter: Ngaire Kerse
Ngaire Kerse¹, Ruth Teh¹, Leah Palaper³, Oliver Menzies¹, Katherine Bacon¹
¹University of Auckland

P3-C-18 Adherence to a programme has greater impact on function and behavioural complexity improvement than group allocation in young seniors at risk of functional decline
Presenter: A. Stefanie Mikolajak
A. Stefanie Mikolajak¹, Kristin Taraldsen¹, Elisabeth Boulton¹, Beatriz Vereijken¹, Chris Todd², Anisa Parascich-Ionescu³, Kamari Aminian³, Andrea Maier⁴, Mirjam Pijnappels⁵, Katharina Gordt¹, Juron Helbostad², Clemens Becker³, Robert Bosch Medical Foundation, ¹Neuroscience Research Australia, University of New South Wales, ²Mount Royal, ³Amsterdam UMC, ⁴Vrije Universiteit Amsterdam

P3-C-19 Gait speed assessed by a 4-meter walk test is not representative of daily-life gait speed in community-dwelling adults
Presenter: Mirjam Pijnappels
Mirjam Pijnappels¹, Jeanine Van Ancum¹, Kimberley van Schooten¹, Nini Jonkman¹, Bas Huijben¹, Rob Van Lummel³, Carel Meskers⁴, Andrea Maier⁴, Vrije Universiteit Amsterdam, ¹Neuroscience Research Australia, University of New South Wales, ²McRoberts, ³Amsterdam UMC, ⁴Vrije Universiteit Amsterdam

P3-C-20 The effect of optic flow stimuli on standing balance in young and older people with low and high fall risk
Presenter: Daina Sturnieks
Daina Sturnieks¹, Matthew Brodie¹, Brandon Chen Yi Tan¹, Michela Persiani³, Stephen Lord¹
¹Neuroscience Research Australia, University of New South Wales, ²Sede di Fisiologia Locomotoria, ³University of Genova & IRCCS San Martino Teaching Hospital

P3-C-21 Effect of functional decline in community-dwelling older adults with low and high fall risk
Presenter: A. Stefanie Mikolajak
A. Stefanie Mikolajak¹, Kristin Taraldsen¹, Elisabeth Boulton¹, Beatriz Vereijken¹, Chris Todd², Anisa Parascich-Ionescu³, Kamari Aminian³, Andrea Maier⁴, Mirjam Pijnappels⁵, Katharina Gordt¹, Juron Helbostad², Clemens Becker³, Robert Bosch Medical Foundation, ¹Neuroscience Research Australia, University of New South Wales, ²Mount Royal, ³Amsterdam UMC, ⁴Vrije Universiteit Amsterdam

P3-C-22 Novel device to enhance balance in young and elderly adults using wearable sensors
Presenter: LiLACS NZ
P3-C-21 Associations between mobility and dementia subtypes in nursing home residents
Presenter: Karen Sverdrup
Karen Sverdrup¹, Sverre Bergh², Geir Selbæk¹, Pernille Thingstad³, Gro Tangen²
Norwegian National Advisory Unit on Ageing and Health, "Rønneland Hospital trust, "Norwegian University of Science and Technology

P3-C-22 Consistency and test-retest reliability of stepping tests designed to measure self-perceived and actual physical stepping ability in older adults
Presenter: Roel Weijer
Roel Weijer¹, Marco Hoozemans¹, Jaap van Dieën¹, Mirjam Pijnappels¹
Vrije Universiteit Amsterdam

D - Biomechanics
P3-D-23 Stiff-knee gait: Effects of knee restriction in the gait of non-impaired individuals
Presenter: Ana Barea
Ana Barea¹, Odair Ramírez², Dinah Santana³, Melissa Celestino¹, Valerya Gritsenko², Sergij Yakovenko², José Barea³
Cruzeiro do Sul University, "West Virginia University, "São Paulo State University (UNESP)

P3-D-24 The effects of varying midsole cushioning in footwear on gait in females with multiple sclerosis
Presenter: Andrew Monaghan
Andrew Monaghan¹, Sutton Richmond¹, Clayton Swanson¹, Daniel Peterson¹, Brett Fling¹
Colorado State University, "Arizona State University

P3-D-25 Anticipatory postural adjustment for an accurate step
Presenter: Masahiro Shinya
Masahiro Shinya¹, Hiroki Yamada¹
Hiroshima University

P3-D-26 Motion patterns that cause the increase of integrated knee muscle torque in individuals with knee osteoarthritis
Presenter: Moeka Sonoo
Moeka Sonoo¹, Tsutomu Fujino², Keisuke Kubota¹, Shunsuke Kita¹, Hiroki Hanawa¹, Keisuke Hirata¹, Takamori Kubukai¹, Naoko Nakemura¹
Saitama Prefectural University, "University of Human Arts and Sciences

P3-D-27 The effect of self-paced and fixed speed treadmill walking on the energetic cost of transport
Presenter: Kyra Theunissen
Kyra Theunissen¹, Guy Plasqui¹, Peter Feye², Annelies Boonen¹, Annick Timmermans², Pieter Meyns², Kenneth Meijer²
Maastricht University Medical Center, "Hasselt University, "Maastricht University

P3-D-28 Are a few millimeters added under the big toe enough to improve postural control in elite handball players?
Presenter: Frederic Vieux
Frédéric Vieux¹, Philippe Villeneuve², Rodolfo Parreira³, Franck Barbiér¹, Antoine Lemaire², Sébastien Letuen²
Université de Valenciennes - France, "Laboratoire de Physiologie du Sport, "Université de Valenciennes et du Hainaut-Cambrésis, "Centre de Recherche en Neurosciences, "Institut des Neurosciences, "Institut des Neurosciences, "Institut des Neurosciences, "Institut des Neurosciences

P3-D-29 The effect of walking speed on cortical activity in young and older adults
Presenter: Lisa Alcock
Lisa Alcock¹, Rodrigo Vitório², Samuel Stuart¹, Lynn Rochester³, Annette Pantall³
Newcastle University, "São Paulo State University (UNESP), "Oregon Health & Science University, "Institute of Neuroscience, "Newcastle University, "Institute of Neuroscience, "Newcastle University

P3-D-30 Parkinson’s disease affects neural activation during continuous alterations to the split-belt treadmill: An [18F] FDG PET Study
Presenter: Dorelle Hinton
Dorelle Hinton¹, Alexander Thiel², Laurent Bouyer², Jean-Paul Soucy³, Caroline Paquette¹
McGill University, "University Laval

P3-E-22 The effect of self-paced and fixed speed treadmill walking on the energetic cost of transport
Presenter: Kyra Theunissen
Kyra Theunissen¹, Guy Plasqui¹, Peter Feye², Annelies Boonen¹, Annick Timmermans², Pieter Meyns², Kenneth Meijer²
Maastricht University Medical Center, "Hasselt University, "Maastricht University

P3-E-23 Activity in the sensorimotor cortex during action observation of walking combined with motor imagery
Presenter: Naotsugu Kaneko
Naotsugu Kaneko¹, Hikaru Yokoyama¹, Yohei Masugi³, Katsumi Watanabe¹, Kimitaka Nakazawa²
University of Tokyo, "Tokyo University of Agriculture and Technology, "Tokyo International University, "Waseda University

P3-E-24 Functional near infrared spectroscopy neuroimaging of prefrontal cortex in Parkinson's disease during cognitive tasks under different postures
Presenter: Graham Kerr
Graham Kerr¹, Mark Muthalib², Roger Pegoraro¹, Luisa Roeder³, Ian Stewart⁴, Simon Smith⁵
Queensland University of Technology, "University of Montpellier, "University of Queensland

P3-E-25 Brain activation during real-time walking post-stroke: Systematic review
Presenter: Shannon Lim
Shannon Lim¹, Dennis Riley Louie¹, Janice Eng¹
University of British Columbia

P3-E-26 Resting state functional connectivity of normal and dual-task walking in healthy older adults
Presenter: On-Yee Lo
On-Yee Amy Lo¹, Mark Halko², Victoria Poole¹, Junhong Zhou¹, Lewis Lipsitz², Brad Manor³
Hebrew SeniorLife / Harvard Medical School, "Beth Israel Deaconess Medical Center / Harvard Medical School, "Harvard Medical School

P3-E-27 Prefrontal and motor cortical activity during stepping tasks in older people at low and high risk of falling
Presenter: Paulo Pelicioni
Paulo Pelicioni¹, Stephen Lord¹, Nigel Seng¹, Bethany Halmy¹, Daina Sturanieks¹, Rui Liu¹, Jasmine Menant¹
Neuroscience Research Australia, "University of New South Wales

P3-E-28 The neural correlates of discrete gait characteristics in ageing: A structured review
Presenter: Joanna Wilson
Joanna Wilson¹, Lisi Alcock², Riona Mc Ardle², John-Paul Taylor², Lynn Rochester³
Vrije Universiteit Amsterdam, "Newcastle University, "Newcastle University, "Newcastle University

F - Cognitive impairments
P3-F-40 Gait as a potential marker of cognitive decrements in Type 2 Diabetes (T2DM): Early results from the ENBIND study
Presenter: Adam Dyer
Adam Dyer¹, Isabelle Killane¹, Benjamin Campbell³, Killian Tobin⁴, Richard Reilly⁵, Isabella Batten¹, Nollaig Bourke¹, James Gibney¹, Sean Kennedy¹
Trinity College Dublin, "Dublin Institute of Technology
P3-F-41  Gait as a signature of cognitive impairment and dementia disease subtype
Presenter: Riona Mc Ardle
Riona Mc Ardle¹, Brook Galna¹, Alan Thomas¹, Lynn Rochester²
¹Newcastle University, ²Institute of Neuroscience, Newcastle University

P3-F-42  Association of gait domains and incident falls in mild cognitive impairment: Results from the gait and brain discharge post stroke
Presenter: Frederico Pieruccini-Faria
Frederico Pieruccini-Faria¹, Yanina Sarquis-Adamson¹, Manuel Montero-Odasso¹
¹University of Western Ontario

P3-F-43  Older people with dementia have reduced daily-life activity and impaired daily-life gait when compared to age-sex matched controls
Presenter: Morag Taylor
Morag Taylor¹, Matthew Brodie¹, Kimberley van Schooten¹, Kim Delbaere¹, Jacqueline Close¹, Narelle Payne¹, Lyndell Webster¹, Jessica Chow¹, Garth Mcnemery¹, Susan Kurrle², Stephen Lord¹
¹Neuroscience Research Australia, University of New South Wales, ²University of Sydney

G - Cognitive, attentional, and emotional influences

P3-G-44  The effects of virtual reality-induced postural threat on performance of a walking balance task
Presenter: Amir Boroomand-Tehrani
Amir Boroomand-Tehrani¹, Andrew Huntley², David Jagroop³, Jennifer Campos², Kara Patterson¹, Luc Tremblay¹, Avril Mansfield²
¹University of Toronto, ²University of Waterloo, ³Ludwig-Maximillians Universität München

P3-G-45  Move aside: Approach-avoidance theories scrutinized
Presenter: Daniëlle Bouman
Daniëlle Bouman¹, John Stins¹, Peter Beek¹
¹Vrije Universiteit Amsterdam

P3-G-46  Priming distorts sense of instability during postural control
Presenter: Adolfo Bronstein
Adolfo Bronstein¹, Patricia Castro¹, Sami Mahmoud², Esfratia Papoutselou³, Constanza Fuentealba³, Qadeer Arshad¹
¹Imperial College London, ²Technische Universität München, ³Universidad San Sebastian

P3-G-47  Patterns of dual-task interference at hospital discharge post stroke
Presenter: Jody Feld
Jody Feld¹, Prudence Plummer³
¹University of North Carolina at Chapel Hill

P3-G-48  The effect of age and anxiety on objective and subjective instability
Presenter: Richard Ibiyote
Patricia Castro¹, Diego Kaski², Richard Ibiyote¹, Marco Schiappetti³, Michael Furman¹, Qadeer Arshad¹, Adolfo Bronstein¹
¹Imperial College London, ²University College London, ³London University

P3-G-49  The nature of motor-cognitive relationship beyond age and disease
Presenter: Inbal Maidan
Inbal Maidan¹, Preeti Sunderaraman¹, Eran Gazit¹, Anat Mirelman¹, Yaakov Stern¹, Jeff Hausdorff³
¹Tel-Aviv Sourasky Medical Center, ²Columbia University Medical Center

P3-G-50  Fear of heights saturates 20 to 40 meters above ground
Presenter: Max Wühr
Max Wühr¹, Katharina Breitkopf¹, Julian Decker¹, Gerado Ibarra¹, Doreen Huppert¹, Thomas Brandt¹
¹Ludwig-Maximilians Universitat München

P3-G-51  The influence of virtual height on visually evoked balance responses
Presenter: Emma Nielsen
Emma Nielsen¹, Taylor Cleworth², Mark Carpenter¹
¹University of British Columbia, ²University of Waterloo

H - Coordination of posture and gait

P3-H-52  Tumors of cerebellum effect on saccadic system and gait
Presenter: Alina Aizenshtein
Alina Aizenshtein¹, Marina Sherupova¹, Vladimir Kasatkin¹, Dmitry Skvortsov¹, Alexander Karelin¹
¹Dmitry Rogachev National Research Center of Pediatric Hematology, Oncology and Immunology, ²Federal Research and Clinical Centre of Russia’s Federal Medical-Biological Agency (FNRC FMBA)

P3-H-53  Daily variation in executive function predicts daily variation in dual task walking performance in older adults
Presenter: Sarah Allen
Sarah Allen¹, Junhong Zhou¹, Alexa Ludington¹, Bonnie Wong¹, Brad Manor²
¹Harvard Medical School

P3-H-54  Effects of discrete visual cues on anticipatory eye movement and segment rotation during walking turns in neurotypical young adults and persons with Parkinson’s disease
Presenter: Tyler Baker
Tyler Baker¹, Jenna Pitman², Adam Johnston², Andrew Godbout¹, Rebecca Reed-Jones¹
¹University of Prince Edward Island, ²University of Guelph

P3-H-55  Modification of gait intralimb coordination: Objective comparison of hip-knee cyclograms of individuals with incomplete spinal cord injury vs healthy subjects
Presenter: Maude Barreau
Maude Barreau¹, Manuel Jose Escalonah Castillo¹, Alexandre Tapin¹, Martin Vermette¹, Dany H. Gagnon¹, Cyril Duclos²
¹Université de Montréal, ²REGLM

P3-H-56  Walking speed choices among married couples: Middle-aged and older adults walk slower when walking with their partner
Presenter: HyeYoung Cho
HyeYoung Cho¹, Anna Forster¹, Samuel Hatala¹, Manuel Ochoa¹, Sharon Christ¹, Melissa Franks¹, Elizabeth Richards¹, Shirley Rietdyk²
¹Purdue University

P3-H-57  Variability of the inter-joint coordination during grade walking
Presenter: Arthur Dewolf
Arthur Dewolf¹, Patrick Willems¹
¹Universite catholique de Louvain

P3-H-58  Effect of voluntary gaze movement on gait steering control
Presenter: Felix Dollack
Felix Dollack¹, Monica Perusuia-Hernandez¹, Hideki Kadone¹, Renji Suzuki¹
¹University of Tsukuba

P3-H-59  How much does pregnancy affect female’s gait pattern?
Presenter: Wanda Forczek
Wanda Forczek¹, Yury Ivanenko², Marcin Salamaga³, Agata Maslon¹, Marta Curylo¹, Barbara Fraczek¹, Agnieszka Suder¹
¹University of Physical Education, ²Technische Universität München, ³Universidade San Sebastian

P3-H-60  Looking downward while walking is more challenging than looking forward for ambulatory chronic stroke patients
Presenter: Yu-Chu Hsieh
Yu-Chu Hsieh¹, Pei-Yun Lee¹, Pei-Yun Lee¹, Chih-Hung Chen¹, Hui-Yu Tseng¹, Sang-H Lin³
¹National Cheng Kung University, ²National Taiwan University Hospital Bei-Hu Branch, ³Tainan Hospital, Ministry of Health and Welfare

P3-H-61  Postural sway in young adults with and without chronic low back pain
Presenter: Karen Lomond
Karen Lomond¹, Nick Pasek², Nihan Aydin³, Deborah Balendra³, Burkhart Zachery³, Phyllion Brooke², Jennifer Sansom³
¹Ithaca College, ²Central Michigan University

P3-H-62  Effect of arm motion on postural strategies during uphill and downhill walking
Presenter: Mary Elise MacDonald
Mary Elise MacDonald¹, Allen Hill¹, Julie Nantel¹
¹University of Toronto
P3-H-63  The path curvature of the body centre of mass during walking as an index of balance control in patients with Multiple Sclerosis

Presenter: Chiara Diletta Malloggi
Chiara Diletta Malloggi¹, Luigi Catino¹, Viviana Rota¹, Laura Perucca¹, Stefano Scarano¹, Luigi Tesio¹
¹IRCCS Santa Lucia Foundation, ²Università degli Studi di Milano

P3-H-64  Older adults adopted a more conservative strategy to step into a hole when compared to the task of stepping down a curb

Presenter: Renato Moraes
Renato Moraes¹, Luciana Santos¹, Rosangela Batistela¹
¹University of São Paulo

P3-H-65  Differences in pre-season postural control based on sport type

Presenter: John Palazzolo
John Palazzolo¹, Daniel Goble², Jeff Labban¹, Scott Ross¹, Donna Duffy¹, Christopher Rhea¹
¹University of North Carolina, Greensboro, ²Oakland University

P3-H-66  Walking with large axial pelvis rotations causes changes in axial thorax-pelvis coordination as observed in low back pain

Presenter: Maarten Prins
Maarten Prins¹, Luca Cornelisse¹, Onno Meijer², Peter van der Woude¹, Sjoerd Bruijn², Jaap van Dieën²
¹University Medical Center Groningen, ²Rehabilitation center Aardenburg, ³Vrije Universiteit Amsterdam

P3-H-67  The modulation of trunk coordination for various step widths

Presenter: Hai-Jung (Steffi) Shih
Hai-Jung (Steffi) Shih¹, Kornelia Kulig¹
¹University of Southern California

P3-H-68  Can a fractal visual motion cue modulate postural sway complexity?

Presenter: Haralampos Sotirakis
Haris Sotirakis¹, Nicholas Stergiou¹, Dimitrios Patikas¹, Vassilia Hatzitaki¹
¹Aristotle University of Thessaloniki, ²University of Nebraska at Omaha

P3-H-70  Motor flexibility during locomotion: An important component of functional mobility in older adults

Presenter: Margit Bach
Margit Bach¹, Andreas Daffertshofer¹, Nadia Dominici¹
¹CNRS, ²CNRS, TIMC-IMAG UMR 5525, ³AMU Université Grenoble Alpes

P3-H-71  Landing under conditions of height-induced threat

Presenter: Bénédicte Schepens
Bénédicte Schepens¹, M J Liu², Mark Carpenter²
¹Université catholique de Louvain, ²University of British Columbia

P3-H-72  Postural sway complexity? A development of a bicycle-simulator-balance training in individuals with vascular lower-limb weight-bearing and balance during early prosthetic training in individuals with vascular lower-limb amputation

Presenter: Cyriel Duclos
Cyriel Duclos¹, Brendon Pham², Valérie Martin-Lemoyne², Dany Gagnon²
¹Université de Montréal, ²Université de Montréal, School of rehabilitation, ³Centre for Interdisciplinary Research in Rehabilitation (CRIR-IRGLM)

P3-H-73  Can a fractal visual motion cue modulate postural sway complexity?

Presenter: Haralampos Sotirakis
Haris Sotirakis¹, Nicholas Stergiou¹, Dimitrios Patikas¹, Vassilia Hatzitaki¹
¹Aristotle University of Thessaloniki, ²University of Nebraska at Omaha

P3-H-74  Muscle activity in the affected leg of stroke survivors: Influence of step width

Presenter: Sylwia Weiland
Sylwia Weiland¹, Heleen Reinders-Messels¹, Annemarie Boonstra¹, Lucas van der Woude¹, Rob den Otter¹
¹University Medical Center Groningen, ²Rehabilitation center Revalidatie Friesland

I - Developmental posture and gait

P3-J-75  The motor control of running in children and their development

Presenter: Margit Bach
Margit Bach¹, Andreas Daffertshofer², Nadia Dominici¹
¹CNRS, ²TIMC-IMAG UMR 5525, ³AMU Université Grenoble Alpes

P3-J-76  Spatiotemporal gait characteristics in adolescent idiopathic toe walkers

Presenter: Richard Beuttler
Rahul Soangra¹, Richard Beuttler¹, Caprice Hollandsworth¹, Shewta Chheda¹, Afsin Aminian¹, Marybeth Grant-Beuttler¹
¹University of Antwerp, ²Antwerp University Hospital

P3-J-77  Balance and postural control in healthy children under 12 years of age: A systematic review

Presenter: Prasath Jayakaran
Prasath Jayakaran¹, Katie Bromley¹, Hayley Foster¹, Nikko Kim¹, Karaiatina Smith¹
¹University of Otto Gồttingen

P3-J-79  Modular control of the leading and trailing limbs during obstacle clearance in children: Preliminary results

Presenter: Michael MacLellan
Michael MacLellan¹
¹University of Prince Edward Island

P3-I-79  Development of postural control during single-leg standing in children aged 3-10 years

Presenter: Hiroki Mani
Hiroki Mani¹, Saori Miyagishima², Naoki Kozuka¹, Kenji Taneda¹, Takahiro Inoue¹, Kenta Takeda¹, Tadayoshi Asaka¹
¹Hokkaido University, ²Sapporo Medical University

J - Developmental disorders

P3-J-81  Feedforward motor control in developmental dyslexia and developmental coordination disorder: Does comorbidity matter?

Presenter: Christine Assaiante
Christine Assaiante¹, Fabien Cignetti², Marianne Vaugoyeau¹, Aurelie Fontan¹, Marianne Jover¹, Brigitte Chabrol¹
¹CNRS, ²CNRS, TIMC-IMAG UMR 5525, ³AMU Université Grenoble Alpes

P3-J-82  Use of cluster analysis for gait classification of patients with syndrome of Dravet

Presenter: Ann Hallemans
Ann Hallemans¹, Lore Wyns¹, Karen Verheyen¹, An-Sofie Schoonjans¹, Berten Ceulemans¹, Patricia Van de Walle¹
¹University of Antwerp, ²Antwerp University Hospital

P3-J-83  Concurrent validity of the Clinical Test of Sensory Interaction of Balance (CTSIB) Kids-BESTest criteria with laboratory center of pressure measures in children with and without cerebral palsy

Presenter: Leanne Johnston
Leanne Johnston¹, Rosalie Dewar¹, Kylie Tucker¹, Andrew Claus², Rob Ware³
¹University of Queensland, ²Griffith University

P3-J-84  Postural control in young adults with high-functioning Autism Spectrum Disorder (ASD): Distinguishing between general and sensory channel-specific impairments

Presenter: Rebekah Knox
Rebekah Knox¹, Mihalis Doumas¹
¹Queen’s University Belfast

K - Devices to improve posture and gait

P3-K-85  A development of a bicycle-simulator-balance trainer with a novel system that provide customized unexpected perturbations during bicycling (the PersBiRo system)

Presenter: Shani Batcir
Shani Batcir¹, Yaakov Livne¹, Rotem Lev Lehman¹, Guy Shani¹, Amir Shapiro¹, Itshak Melzer¹
¹Bnai-Gurion University

P3-K-86  Immediate effect of a rehabilitation dog on weight-bearing and balance during early prosthetic training in individuals with vascular lower-limb amputation

Presenter: Cyriel Duclos
Cyriel Duclos¹, Brenda Pham², Valérie Martin-Lemoyne², Dany Gagnon²
¹Université de Montréal, ²Université de Montréal, School of Rehabilitation, ³Centre for Interdisciplinary Research in Rehabilitation (CRIR-IRGLM)
P3-K-87 Effect of multi-tasking on gait and cognitive demands in adults with Alzheimer’s dementia experienced in using a 4-wheeled walker
Presenter: Susan Hunter
Susan Hunter¹, Alison Divine², Humberto Omana³, Walter Wittich³, Andrew Johnson¹, Keith Hill¹
¹University of Western Ontario, ²University of Leeds, ³University of Montreal, ⁴Lutin University

P3-K-88 Evaluation of corrective moment of measurement orthosis using CB brace for knee osteoarthritis
Presenter: Yasuhiro Mine
Yasuhiro Mine¹, Tamotsu Sakima³
¹Toyo University, ²SKAMLA Prosthetics & Orthotics Co.,Ltd.

P3-K-89 Development of an active mechanical harness system
Presenter: Ann Reinthal
M Ann Reinthal¹, Debbie Espy¹, Lorenzo Bianco¹, Poya Khalaf³, John DeMarco¹
¹Cleveland State University

P3-K-90 Plantar foot mecanorheotopgraphy and lower limb muscle activity
Presenter: Kelly Robb
Kelly Robb¹, Stephen Perry²
¹Wilfrid Laurier University

P3-K-91 Spinal cord stimulation improves gait and modulates cortical activity in parkinsonian patients unresponsive to dopaminergic medication
Presenter: Olivia Samotus
Olivia Samotus¹, Maria Alamos¹, Andrew Parrent¹, Mandar Jog¹
¹London Health Sciences Centre, ²Pontificia Universidad Catolica de Chile

P3-K-92 How to encourage others: A perception- empathy biofeedback system for preventing falls in older adults
Presenter: Kazuhiro Yasuda
Kazuhiro Yasuda¹, Yuki Hayashi¹, Hiroyasu Iwata¹
¹Waseda University

L - Effect of medication on posture and gait
P3-L-93 Gait speed does not mediate the association between antidepressants and falls
Presenter: Orna Donoghue
Orna Donoghue¹, Robert Briggs², Frank Moriarty², Rose Kenny³
¹Trinity College Dublin, ²Royal College of Surgeons in Ireland

M - Exercise and physical activity
P3-M-95 Perturbation treadmill training: Sustainable effects on clinical gait and postural stability symptoms as well as gait variability in Parkinson’s disease
Presenter: Heiko Gafner
Heiko Gafner¹, Simon Steib¹, Sarah Klamroth¹, Cristian Paslousta³, Werner Adler¹, Bjornn Eskofier¹, Klaus Pfeifer¹, Jürgen Winkler¹, Jochen Klucken³
¹University Hospital Erlangen, ²Friedrich-Alexander University (FAU) Erlangen-Nürnberg

P3-M-96 Clinical outcome measures and the patient experience: What we can learn from conducting a process evaluation of a balance training intervention
Presenter: Breifini Leavy
Breifini Leavy¹, Conran Joseph¹, Hanna Johansson¹, Erika Franzén¹
Xarolinska Institutet

P3-M-97 Effect of community-based brisk walking on enhancing motor and non-motor symptoms in people with Parkinson’s disease
Presenter: Margaret Mak
Margaret Mak¹, Irene Wong¹
¹The Hong Kong Polytechnic University

P3-M-98 Effects of strength training the hip abductor-aductor muscles on protective stepping: A pilot study
Presenter: Marie-Laure Mille
Marie-Laure Mille¹, Maria Papaioiandandou¹, Guillaume Florent¹, Karim El Kouali², Jean-Louis Vercher³, Richard Fitzpatrick⁴
¹Aix Marseille Université, ²URF STAPS, Univ. de Bourgogne, ³CNRS & Aix-Marseille Univ, ⁴University of New South Wales

P3-M-99 Effect of muscle fatigue on postural stability and muscular activation of the supporting leg in soccer players’ kicking
Presenter: Julia Oliveira
Julia Oliveira¹, Caroline Souza¹, Daniel Coelho¹, Luis Teixeira¹
¹University of Sao Paulo

N - Falls and fall prevention
P3-N-100 Increased resilience of judoists to unpredictable large-magnitude perturbations to body balance
Presenter: Marina Betelli
Marina Betelli¹, Julia Oliveira¹, Patricia Takazono¹, Caroline Souza¹, Daniel Coelho¹, Luis Teixeira¹
¹University of Sao Paulo

P3-N-101 The effect of hearing loss on balance control - Do hearing aids help?
Presenter: Nicoleta Bugnariu
Nicoleta Bugnariu¹, Victoria Kowalewski¹, Rita Patterson¹, Linda Thibodeau¹
¹University of North Texas Health Science Center, ²University of Texas at Dallas

P3-N-102 Synergistic ground reaction forces during double support while negotiating a curb
Presenter: Chuyi Cui
Chuyi Cui¹, HyeYoung Cho¹, Ashwini Kulkarni¹, Shirley Riedtyck¹, Fabio Barbieri¹, Satyajit Ambike¹
¹Purdue University, ²Sao Paulo State University (UNESP)

P3-N-103 The effect of handrail cross-sectional design on centre of mass control during compensatory reach-to-grasp reactions to protraction
Presenter: Philippa Gosine
Philippa Gosine¹, Vicki Komisar², Alison Novak¹
¹Toronto Rehabilitation Institute, ²Simon Fraser University

P3-N-104 Falls and hip fractures: A biomechanically based model of sex and age specific risk assessment
Presenter: Andrew Hudson
Andrew Hudson¹, Brian Street¹
¹University of California, Bakersfield, ²California State University, Bakersfield

P3-N-105 Effects of thin plantar stimulation on postural coordination patterns
Presenter: Marc Janin
Marc Janin¹, Emmanuelle Pirron Braquet¹, Frédéric Noe³
¹Université de Pau et des pays de l’Adour, ²PODOLOGUE, ³Laboratoire Mouvement, Equilibre, Performance, Santé (EA 4445)

P3-N-106 Sex differences in predictors of subsequent falls in senior fallers: A prospective study of the Vancouver Falls Prevention Cohort
Presenter: Deborah Jehu
Deborah Jehu¹, Jennifer Davis¹, Kristin Vesley¹, Winnie Cheung¹, Anna Egbert¹, Liu-Ambrose Teresa¹
¹University of British Columbia

P3-N-107 The frequency and circumstances of falls reported by unilateral lower limb prosthes users
Presenter: Janis Kim
Janis Kim¹, Matthew Major², Brian Hafner², Andrew Sawars³
¹University of Illinois at Chicago, ²Northernwestern University, ³University of Washington

P3-N-108 Effect of holding and grasping objects on risk for head impact during falls in older adults
Presenter: Vicki Komisar
Vicki Komisar¹, Nataliya Shishov¹, Stephen Robinovitch¹
¹Simon Fraser University

P3-N-109 Different types of tripping over an unexpected obstacle while walking on level ground - age and contributing factors
Presenter: Ran Kurz
Ilan Kurz¹, Shlomit Eyal¹, Inbal Maiden¹, Anat Mirelman¹, Nir Giladi¹, Jeff Hausdorff²
¹Ben-Gurion University, Center for the Study of Movement, Cognition and Mobility, Neurological Institute, ²Tel Aviv Sourasky, Tel-Aviv Sourasky Medical Center

P3-N-110 Balance control in young healthy adults: Is relative performance across tasks indicative of a balance control characteristic?
Presenter: Gary Mangan
Gary Mangan¹, William McIlroy³
¹University of Waterloo
P3-Q-138  Evaluation of gait parameter thresholds to persons with multiple sclerosis exhibit declines in upper normal daily monitoring

Presenter: Markus Hobert¹, Nicholas D'Cruz², Alice Nieuwboer²

¹University Hospital, LMU Munich, ²Ludwig-Maximilians University, Munich

P3-Q-141  Balance control impairments in Fabry disease

Presenter: Dominik Pernour

P3-Q-144  Global lower limb coactivation during gait in patients with cerebellar ataxia

Presenter: Mariano Serrao

Mariano Serrao¹, Lorenzo Fiori², Tiwana Varrechcia³, Carmela Conte¹, Antonella Tatarrelli², Carlo Casali¹, Francesco Pierelli¹, Francesco Draiaco², Alberto Ranavolo³, Sapienza University of Rome, ²NAI, ³University Roma Tre, Fondazione Don Gnocchi, Milan

P3-Q-145  Clinical correlates of fatigue in patients with multiple sclerosis: Is mental fatigue more important than gait speed?

Presenter: Shirley Shema Shirahtzky

Shirley Shema Shirahtzky¹, Ruopeng Sun², Keren Regev¹, Arnon Karni¹, Jacob Sosnoff², Jeff Hausdorff¹, Anat Mirelman¹

¹Tel-Aviv Sourasky Medical Center, ²University of Illinois at Urbana-Champaign

P3-Q-146  Does transcranial direct current stimulation improve reaction times of people after stroke during balance perturbations, gait initiation, or voluntary movement?

Presenter: Wouter Staring

Wouter Staring¹, Milou Coppens¹, Alexander Geurts¹, Wouter Staring², Milou Coppens¹, Alexander Geurts¹

¹Université de Lorraine et CHRU de Nancy, ²Université Paul-Sabatier

P3-Q-134  Diurnal systematic variance of gait during walking performance in people with multiple sclerosis: Is mental fatigue more important than gait speed?

Presenter: James McNamess

James McNamess¹, Vrutangkumar Shah², Patty Carlson-Kuhta³, Mahmoud El-Gohary⁴, John Nutt⁵, Rebecca Spain⁶, Fay Horak⁷, Carolin Curtz⁸

¹Portland State University, ²Oregon Health & Science University, ³APDOM, ⁴University of Nebraska Omaha

P3-Q-135  Objective quantifiable assessment of nocturnal movements in patients with Parkinson’s disease using a wearable sensor

Presenter: Anat Mireleman

Anat Mireleman¹, Inbar Hillel¹, Lynn Rochester², Bastiaan Bloem³, Laura Avanzino⁴, Alice Nieuwboer⁵, Inbal Maidan⁶, Shirley Shiratzky⁷, Talia Herman⁸, Jesse Cederbaum⁹, Nir Gili¹⁰, Jeff Hausdorff¹¹

¹Old Dominion University, ²University of Colorado, ³University of Illinois at Chicago, ⁴University Hospital Grenoble-Alpes, ⁵KU Leuven, ⁶Biogen Biotechnologies, ⁷Tel-Aviv Sourasky Medical Center, ⁸Institute of Neuroscience, Newcastle University, ⁹Radboud University Medical Center, ¹⁰University of Genoa, ¹¹Tel-Aviv Sourasky Medical Center, Institute of Neuroscience, Newcastle University, Radboud University Medical Center, University of Genoa, KU Leuven, Biogen Biotechnologies, Cambridge Massachusetts

P3-Q-137  Persons with MS exhibit declines in upper body control during walking

Presenter: Steven Morrison

Steven Morrison¹, Cortney Armitano¹, Corey Rynders², Jake Sosnoff³

¹Old Dominion University, ²University of Colorado, ³University of Illinois at Chicago

P3-Q-139  Fast paced gait may be more discriminating than dual tasking for detecting severity of gait and turn deficits in Fragile X-Associated Tremor/Ataxia Syndrome (FXTAS)

Presenter: Joan O’Keefe

Joan O’Keefe¹, Danielle Carsn², Joseph Guan², Erin Robertson³, Timothy Tung³, Nicolette Purcell³, Elizabeth Berry-Kravis¹, Deborah Hall²

¹University of Rochester, ²Yush University Medical Center

P3-Q-143  The impact of split-belt treadmill walking on freezing related gait features in Parkinson’s disease

Presenter: Christian Schlenstedt

Christian Schlenstedt¹, Jana Seuthè², Pieter Ginis³, Markus Hobert¹, Nicholas D’Cruz², Alice Nieuwboer Correction: Alice-Nieuwboer²

¹Christian-Albrechts-University of Kiel, ²Yush University

P3-Q-140  Does transcranial direct current stimulation improve reaction times of people after stroke during balance perturbations, gait initiation, or voluntary movement?

Presenter: Wouter Staring

Wouter Staring¹, Milou Coppens¹, Alexander Geurts¹, Vivian Weerdesteyn²

¹Bond Institute, Radboud University Medical Centre

P3-Q-139  Fast paced gait may be more discriminating than dual tasking for detecting severity of gait and turn deficits in Fragile X-Associated Tremor/Ataxia Syndrome (FXTAS)

Presenter: Joan O’Keefe

Joan O’Keefe¹, Danielle Carsn², Joseph Guan², Erin Robertson³, Timothy Tung³, Nicolette Purcell³, Elizabeth Berry-Kravis¹, Deborah Hall²

¹University of Rochester, ²Yush University Medical Center

P3-Q-140  Does transcranial direct current stimulation improve reaction times of people after stroke during balance perturbations, gait initiation, or voluntary movement?

Presenter: Wouter Staring

Wouter Staring¹, Milou Coppens¹, Alexander Geurts¹, Vivian Weerdesteyn²

¹Bond Institute, Radboud University Medical Centre

P3-Q-144  Global lower limb coactivation during gait in patients with cerebellar ataxia

Presenter: Mariano Serrao

Mariano Serrao¹, Lorenzo Fiori², Tiwana Varrechcia³, Carmela Conte¹, Antonella Tatarrelli², Carlo Casali¹, Francesco Pierelli¹, Francesco Draiaco², Alberto Ranavolo³, Sapienza University of Rome, ²NAI, ³University Roma Tre, Fondazione Don Gnocchi, Milan

P3-Q-145  Clinical correlates of fatigue in patients with multiple sclerosis: Is mental fatigue more important than gait speed?

Presenter: Shirley Shema Shirahtzky

Shirley Shema Shirahtzky¹, Ruopeng Sun², Keren Regev¹, Arnon Karni¹, Jacob Sosnoff², Jeff Hausdorff¹, Anat Mirelman¹

¹Tel-Aviv Sourasky Medical Center, ²University of Illinois at Urbana-Champaign

P3-Q-146  Does transcranial direct current stimulation improve reaction times of people after stroke during balance perturbations, gait initiation, or voluntary movement?

Presenter: Wouter Staring

Wouter Staring¹, Milou Coppens¹, Alexander Geurts¹, Vivian Weerdesteyn²

¹Bond Institute, Radboud University Medical Centre

P3-Q-147  Protective stepping in multiple sclerosis: A pilot study

Presenter: Charles Van Liew

Charles Van Liew¹, Eland Dibble¹, Grace Hunt², K. Foreman³, Daniel Peterson⁴

¹Arizona State University, ²University of Utah

P3-Q-148  Walking speed improves with arm swing manipulation in people with Parkinson’s disease

Presenter: Vinicius Zampier

Vinicius Zampier¹, Rodrigo Vitório¹, Victor Beretta¹, Diego Jaimes¹, Diego Orcioli-Silva², Lilian Gobbi³

¹São Paulo State University (UNESP), ²University of Lorraine et University Hospital Nancy

P3-Q-149  The effects of Parkinson’s disease and essential tremor on the multiscale dynamics of hand tremor motion

Presenter: Junhong Zhou

Junhong Zhou¹, Dongping Su², Shuo Yang³, Ying Wang⁴, Zhu Liu⁵, Hua Pan⁶, Tao Feng⁷

¹Harvard Medical School, ²Beijing Tiantan Hospital, Capital Medical University

R - Orthopedic diseases and injuries

P3-R-150  Effects of repetitive head impacts on tandem gait performance over an ice hockey season

Presenter: Melissa DiFabio

Melissa DiFabio¹, Jessie Oldham², Thomas Buckley³

¹University of Delaware, ²Boston Childrens Hospital, ³University of Iowa

P3-R-151  How persons with transtibial amputation regulate lateral stepping in environments with ice

Presenter: Jonathan Dingwell

Jonathan Dingwell¹, Jonathan Rylander², Joseph Cusumano³, Jason Wilken⁴

¹Pennsylvania State University, ²Baylor University, ³University of Iowa

P3-R-152  Knee joint function and walking biomechanics in patients in acute phase anterior cruciate ligament (ACL) tear

Presenter: Dmitriy Skvortsov

Sergey Kaurkin¹, Dmitriy Skvortsov¹, Alexander Akhapshiev²

¹Federal Research and Clinical Centre of Russia’s Federal Medical-Biological Agency (FRNKB), ²Federal Research and Clinical Centre of Russia’s Federal Medical-Biological Agency (FRNKB)

P3-R-153  Function of the knee joint during walking before and after the meniscus resection

Presenter: Dmitriy Skvortsov

Sergey Kaurkin¹, Dmitriy Skvortsov¹, Alexander Akhapshiev²

¹Federal Research and Clinical Centre of Russia’s Federal Medical-Biological Agency (FRNKB), ²Federal Research and Clinical Centre of Russia’s Federal Medical-Biological Agency (FRNKB)
S - Proprioceptive function and disorders

P3-S-154 Reduced balance stability in obese individuals is associated with low tactile sensibility of the feet soles
Presenter: Luis Teixeira, Luis Teixeira, Jair Bueno, Caroline Souza, Daniel Coelho, University of Sao Paulo

P3-S-155 Investigation of the relationship between taking time on the mobile phone and neck proprioception, pain, and disability in the university students
Presenter: Gamze Yalcinkaya, Gamze Yalcinkaya, Nurullah Beker, Yesim Sengul, Health Sciences Institute

U - Robotics

P3-U-156 Does the selection of specific control strategy options during walking with a wearable robotic exoskeleton affect muscle synergies in healthy individuals?
Presenter: Manuel J. Escalona, Manuel Escalona, Daniel Bourbonnas, Damien Le Fliet, Michel Goyette, Cyril Duclos, Dany Gagnon, University of Montreal

P3-U-157 Do high and low spinal cord injured subjects learn exoskeleton skills differently?
Presenter: Rosanne van Dijseldonk, Rosanne van Dijseldonk, J.W. van Nes, H. Rijken, H. van de Meent, N.L.W. Keijsers, Radboud University Medical Center

V - Sensorimotor control

P3-V-158 A balance control model for vestibular loss
Presenter: Thomas Mergner, Thomas Mergner, van de Meent, N.L.W. Keijsers, Rosanne van Dijsseldonk, I.J.W. van Nes, H. Rijken, H. Pijnappels, ³Radboud University Medical Center

P3-V-159 Synergies between postural control, eye movements and cognitive involvement in precise visual tasks performed upright
Presenter: Cédric Bonnet, Cedrick Bonnet, Tanguy Davin, Jean-Yves Hoang, Stéphane Baudry, ¹University of Liège, ²Université Libre de Bruxelles

P3-V-160 How does visual input affect the learning of a balance task?
Presenter: Orit Elion, Orit Elion, Yotam Bahat, Itamar Sela, Itzcchak Siev-Nevo, Patrice (Tamar) Weiss, Avi Karmi, ¹Tel Aviv University, ²Sheba Medical Center, ³University of Haifa, ⁴Sheba Medical Center, Tel Hashomer, Israel

P3-V-161 Obesity and gait: where/when body representation and its symbolic counterpart meet in the brain?
Presenter: Marie Fabre, Marie Fabre, Pascale Chavel, Théo Forneronne, Benjamin Juin, Olivier Abossolo, Fabrice Pardo, Lionel Dany, Laurence Mouchinina, ¹Aix Marseille Université, ²Clinique St Christophe, ³Clinique St Christine

P3-V-162 Postural control during induced stabilization of the center of mass and light touch
Presenter: Dasa Gorjan, Dasa Gorjan, Angéline Bellicha, Jérme Camernik, Wael Bactha, Jan Babić, ¹Institute Jozef Stefan, ²Carbone University - ISIR

P3-V-163 Comparison of EMG parameters during uphill walking on a self-paced treadmill and outdoors
Presenter: Eunice Ibaña, Eunice Ibaña, Karen Chase, Nicholas Smith, Andrew Kerr, ¹University of Strathclyde

P3-V-164 Anticipatory postural adjustments while initiating a step on a flat surface or over an obstacle
Presenter: Hirofumi Iida, Hirofumi Iida, ¹Jobu University

P3-V-165 Central sensorimotor integration delays: Does response latency to pseudorandom balance perturbations relate to reaction time?
Presenter: Douglas Martini, Douglas Martini, Lucy Farrington, Peter Fino, Robert Peterka, Laurie King, ¹Oregon Health & Science University, ²University of Utah

P3-V-166 Augmenting balance with tactile robotic feedback
Presenter: Raymond Reynolds, Raymond Reynolds, Lorenz Assländner, Craig Smith, ¹University of Birmingham, ²University of Konstanz

P3-V-167 Foot sole cutaneous stimulation mitigates plantar flexor fatigue
Presenter: Simone Smith, Simone Smith, Geoffrey Power, Leah Bent, ¹University of Guelph

P3-V-168 Lightbulb characteristics affect stepping biomechanics during stair descent in young and older adults
Presenter: Neil Thomas, Neil Thomas, Costis Maganaris, Thomas O’Brien, Richard Foster, Vasilios Baltzopoulos, Carolyn Lees, Timmion Sveinari, Mark Hollands, ¹Liverpool John Moores University

P3-V-169 Performance of dual-tasking between arm movement and postural adjustments in subjects with stroke
Presenter: Yusuke Tomita, Yusuke Tomita, Nicolas Turpin, Daniele Piscitelli, Mindy Levin, ¹Takasaki University of Health and Welfare, ²University of la Réunion, ³McGill University

P3-V-170 Unidirectional beta connectivity from motor cortex to muscle is involved in voluntary modification of locomotor muscle activity in humans
Presenter: Hikaru Yokoyama, Hikaru Yokoyama, Naotsugu Kaneko, Yohei Masugi, Tetsuya Ogawa, Katsumi Watanabe, Kimitaka Nakazawa, ¹Tokyo University of Agriculture and Technology, ²University of Tokyo, ³Tokyo International University, ⁴Waseda University

W - Tools and methods for posture and gait analysis

P3-W-171 Straight vs curved walking: Quantification of dynamic balance through an instrumented version of the Figure-of-8 Walk Test
Presenter: Valeria Belluscio, Valeria Belluscio, Elena Bergamini, Yuri Russo, Amaranta Orejel Bustos, Marco Tramontano, Giuseppe Vannozzi, ¹Interuniversity Centre of Bioengineering Bohnes, University of Rome Foro Italico, ²Santa Lucia Foundation

P3-W-172 Extending the centre of pressure to include handhold forces
Presenter: James Borrelli, Emily King, James Borrelli, Vicki Komisar, Brian Maki, Alison Novak, ¹University of Waterloo, ²University of Maryland, ³Simon Fraser University, ⁴Toronto Rehabilitation Institute

P3-W-173 Normative data for Balance Tracking System (BTrackS) modified Clinical Test of Sensory Integration and Balance (mCTSIB)
Presenter: Daniel Goble, Daniel Goble, Harshan Brar, Elise Brown, Charles Marks, ¹Oakland University, ²San Diego State University

P3-W-174 Gaps between gait measured in the lab during usual and dual-task walking compared to free-living walking: Evidence from 24/7 monitoring of older adults
Presenter: Inbar Hillel, Inbar Hillel, Laura Avanzino, Lynn Rochester, Ugo Della Croce, Marcel Olde Rikkert, Silvia Del Din, ¹Tel-Aviv Sourasky Medical Center, ²University of Genoa, ³Institute of Neuroscience, Newcastle University, ⁴University of Sassan & Interuniversity Centre of Bioengineering of the Human Neuromusculoskeleton, ⁵Donders Institute, Radboud University Medical Centre, ⁶Newcastle University, ⁷KU Leuven
POSTER SESSION INFO

P3-W-175 Development of a body balance assessment system with integrated virtual reality technology; construct validity testing in healthy older adults
Presenter: Yu Imaoka
Yu Imaoka¹, Nadja Saba¹, Anne Vanhoestenberghe², Eling de Bruin³
ETH Zurich, ¹University College London, ²Karolinska Institutet

P3-W-176 A novel functional ambulation toolkit to assess children with locomotor deficits
Presenter: Alexandra Leclerc-Valade
Alexandra Leclerc-Valade¹, Liav Lugassy⁴, Zachary Weber⁵, Elizabeth Dannenbaum⁶, Claire Perez⁷, Filomena Pietrangelo⁸, Lora Salvo⁹, Joyce Fung¹⁰
¹McGill University, ²Jewish Rehabilitation Hospital (CISSS-Laval)

P3-W-177 A do-it-yourself low-cost foot switch device to measure stride intervals
Presenter: Masahiro Okano
Masahiro Okano¹, Tadao Isaka¹
¹Ritsumeikan University

P3-W-178 Performance of surface and fine-wire electrodes over time when recording from the tibialis anterior in walking
Presenter: Joanna Reeves
Joanna Reeves¹, Chelsea Starbuck¹, Wasseem Rafiq¹, Chris Nester¹
¹University of Salford

P3-W-179 Integrating technology into clinical practice for the assessment of balance and mobility: Perspectives of exercise professionals practicing in retirement and long-term care
Presenter: Kathryn Sibley
Kathryn Sibley¹, Karen Van Ootechhem², Elizabeth Inness³, Avril Mansfield³, Jaimie Killingbeck⁴
¹University of Manitoba, ²University of Waterloo, ³Toronto Rehabilitation Institute, ⁴Schlegel Villages

P3-W-180 Accepting the null hypothesis: How and why?
Presenter: John Stins
John Stins¹
¹Vrije Universiteit Amsterdam

P3-W-181 Muscle coordination changes with assistance from lumbar support exoskeleton
Presenter: Chun Kwang Tan
Chun Kwang Tan¹, Hideki Kadone¹, Kousei Miura², Tetsuya Abe³, Masao Koda³, Yasushi Hada³, Masashi Yamazaki¹, Yoshiyuki Sankai⁴, Kenji Suzuki¹
¹University of Tsukuba, ²Faculty of Medicine, University of Tsukuba Hospital

P3-W-182 Application and evaluation of the extrapolated centre of mass as a clinical gait stability measure
Presenter: Albert Vette
Albert Vette¹, Jeremy Hall¹, Juan Forero¹, Jacqueline Hebert¹
¹University of Alberta

P3-W-183 Influence of taking a rest between measurement of stabiliometry with eyes open and closed
Presenter: Tomoe Yoshida
Tomoe Yoshida¹, Masahiko Yamamoto¹, Kazuo Ishikawa², Eigo Ohmi³
¹Toho University, ²Japanese Red Cross Akita Hospital, ³Akita University

X - Vestibular function and disorders

P3-X-184 Abnormal subjective vertical perception in patients with vestibular migraine
Presenter: Mitsuhiro Aoki
Mitsuhiro Aoki¹, Hisamitsu Hayashi¹, Bunya Kuze¹
¹Gifu University Hospital

P3-X-185 Recovery of head trunk kinematics during functional movement tasks following unilateral vestibular hypofunction
Presenter: Lee Dibble
Lee Dibble¹, Brian Loyd¹, Grace Hunt¹, Mark Lester², Serene Paul³
¹University of Utah, ²Army-Baylor University, ³University of Sydney

Y - Visual function and disorders

P3-Y-188 Virtual perturbations: Individual differences in static posture
Presenter: Robert McIlroy
Robert McIlroy¹, Michael Barnett-Cowan¹
¹University of Waterloo

P3-Y-189 Visual exploration during walking and turning in mild traumatic brain injury and controls
Presenter: Samuel Stuart
Samuel Stuart¹, Lucy Parrington¹, Doug Martin², Peter Fino³, James Chesnutt³, Laurie King³
¹Oregon Health & Science University, ²Oregon Health & Science University, ³University of Utah

P3-Y-190 Measuring dynamic balance control in children with cerebral palsy
Presenter: Ruud van der Weel
Ruud Van der Weel¹, Audrey van der Meer¹
¹Norwegian University of Science & Technology
AMTI (TT3)

AMTI understands that the best research begins with the best equipment. We continually strive to develop the most accurate and reliable Multi-Axis Force Platforms and Sensors for your biomechanics research. Our innovative OPTIMA performance system revolutionizes multi-axis force measurement technology offering a 10-fold improvement in accuracy over any other force platform on the market. Whether studying Balance, Gait, or Sport Biomechanics, researchers and clinicians around the world rely on AMTI platforms to deliver the most accurate force measurements. Shouldn’t you? Stop by our booth or visit our website www.amti.biz to learn more about what we have to offer.
sales@amtimail.com
www.amti.biz

APDM Wearable Technologies (Booth 3)

APDM offers solutions for quantifying human movement by combining Opal sensors with sophisticated algorithms. Deployed by thousands of researchers and clinicians worldwide, APDM solutions streamline data collection and analysis. Mobility Lab generates spatiotemporal gait and balance outcome measures and has been used to analyze disease-sensitive outcome measures in neurodegenerative conditions as well as to more precisely track a patient’s response to an intervention by clinicians and in pharma clinical trials. Other solutions include Motion Studio for access to precisely synchronized raw inertial data and Moveo Explorer for automated full body kinematic data analysis including joint angles.
sales@apdm.com
apdm.com
@APDMInc

Charnwood Dynamics Limited/Codamotion (TT 4)

Codamotion

Pioneering 3D Motion capture for 30 years, for research and Clinical applications. Our technology is used by leading Gait Labs worldwide. An active marker technology that is cost affective, portable and easy to use.
info@codamotion.com
www.codamotion.com
@codamotion

CIR Systems/GAITRite (Booth 10)

GAITRite

World Leader for 26 years in Temporo-Spatial Gait Analysis, GAITRite® Systems capture with unsurpassed accuracy, objective data necessary to reliably document patient condition and progression. Our unique proprietary software identifies, through a multitude of specific Spatial-Temporal Gait parameters, asymmetries and deviations from normal time and distance values. In the research venue, GAITRite® allows for the building of large subject databases for extensive data mining. The new 3D Camera allows for upper body data collection by simply walking on the system. GAITRite has in excess of 11,000 worldwide peer reviewed publications in research & numerous disciplines.
sales@gaitrite.com
www.gaitrite.com

Cometa Systems (TT6)

Cometa Systems is a leading provider of medical and research instruments for motion analysis. Our wireless EMG and IMU sensors are the smallest on the market, can be easily integrated with other systems, and are the only ones to be IPX7 certified for underwater use.
sales@cometasystems.com
www.cometasystems.com

Delsys Europe (Booth 8)

Delsys

Delsys, being at the forefront of innovative developments in Electromyography (EMG) for more than 25-years, has established the foundation for unmatched signal quality, consistency, reliability and, continues to challenge the status quo to put technology in the hands of researchers and clinicians. The Delsys Trigno wireless technology builds upon this solid foundation allowing unrestricted subject motion while maintaining unmatched signal quality. Acutely demonstrated through the latest Trigno sensor upon this solid foundation allowing unrestricted subject motion while maintaining unmatched signal quality. Upon this solid foundation allowing unrestricted subject motion while maintaining unmatched signal quality. Acutely demonstrated through the latest Trigno sensor technologies such as Trigno Avanti and Trigno Quattro sensors providing EMG and IMU through both desktop and mobile applications.
admin@delsysEurope.com
www.delsys.com/home/
@delsysinc

Elsevier (Gait & Posture Journal)

Sponsor of the Emerging and Promising Scientist Awards
Gait & Posture is the official journal of ISPGR and is a vehicle for the publication of up-to-date basic and clinical research on all aspects of locomotion and balance. The topics covered include: Techniques for the measurement of gait and posture, and the standardization of results presentation; Studies of normal and pathological gait; Treatment of gait and postural abnormalities; Biomechanical and theoretical approaches to gait and posture; Mathematical models of joint and muscle mechanics; Neurological and musculoskeletal function in gait and posture; The evolution of upright posture and bipedal locomotion; Adaptations of carrying loads, walking on uneven surfaces, climbing stairs etc; spinal biomechanics only if they are directly related to gait and/or posture, and are of general interest to our readers; The effect of aging and development on gait and posture; Psychological and cultural aspects of gait; Patient education.
www.journals.elsevier.com/gait-and-posture

Cometa Systems (TT6)

Cometa Systems is a leading provider of medical and research instruments for motion analysis. Our wireless EMG and IMU sensors are the smallest on the market, can be easily integrated with other systems, and are the only ones to be IPX7 certified for underwater use.
sales@cometasystems.com
www.cometasystems.com

Delsys Europe (Booth 8)

Delsys

Delsys, being at the forefront of innovative developments in Electromyography (EMG) for more than 25-years, has established the foundation for unmatched signal quality, consistency, reliability and, continues to challenge the status quo to put technology in the hands of researchers and clinicians. The Delsys Trigno wireless technology builds upon this solid foundation allowing unrestricted subject motion while maintaining unmatched signal quality. Acutely demonstrated through the latest Trigno sensor technologies such as Trigno Avanti and Trigno Quattro sensors providing EMG and IMU through both desktop and mobile applications.
admin@delsysEurope.com
www.delsys.com/home/
@delsysinc

Elsevier (Gait & Posture Journal)

Sponsor of the Emerging and Promising Scientist Awards
Gait & Posture is the official journal of ISPGR and is a vehicle for the publication of up-to-date basic and clinical research on all aspects of locomotion and balance. The topics covered include: Techniques for the measurement of gait and posture, and the standardization of results presentation; Studies of normal and pathological gait; Treatment of gait and postural abnormalities; Biomechanical and theoretical approaches to gait and posture; Mathematical models of joint and muscle mechanics; Neurological and musculoskeletal function in gait and posture; The evolution of upright posture and bipedal locomotion; Adaptations of carrying loads, walking on uneven surfaces, climbing stairs etc; spinal biomechanics only if they are directly related to gait and/or posture, and are of general interest to our readers; The effect of aging and development on gait and posture; Psychological and cultural aspects of gait; Patient education.
www.journals.elsevier.com/gait-and-posture
Gait Up SA (Booth 14)  

Gait Up  

Motiveforce Link (Booth 1)  

Motek is a global leader in virtual reality and robotics research and rehabilitation, combining almost 20 years of experience in high-level technologies. Building the most versatile devices, Motek integrates the latest technologies ensuring real-time data quality and synchronization. From global knowledge exchange to unique research set-ups, Motek empowers every stage of your research on human movement. Together, we will set future standards to maintain healthy and independent lifestyles for everyone.

NDI (Northern Digital Inc) (Booth 2)  

MediTouch (TT2)  

NDI is a global-leading innovator and manufacturer of 3D measurement and motion tracking solutions. Since 1981 we've helped our customers bring optical and electromagnetic tracking to image-guided surgery, biomechanics research, automotive assembly, AR/VR, and so much more. NDI is headquartered in Waterloo, Canada, with 225+ employees across four global offices.

Neurosoft (TT1)  

The Neurosoft Company was founded in 1992. Nowadays it is one of the largest manufacturers of the medical equipment for neurophysiology and electrodiagnostics. We manufacture devices for EEG, EMG, ECG, TMS, IOM, PSG, rehabilitation and other fields. Rehabilitation is one of the most promising and priority vectors of the company’s development. The Neurosoft Company can offer the customers the Steadys gait assessment and training system with biofeedback, the Multitrainer digital system for cardiac rehabilitation and the Neuro-MS/D transcranial magnetic stimulator that has proven itself in the treatment of many psychiatric and neurological disorders.

Vicon Motion Systems Ltd (Booth 2)  

ProtoKinetics Gait Analysis Walkways (Booth 9)  

ProtoKinetics offers the premiere Gait Analysis System: Zeno Walkway powered by PKMAS software: quantify, track, trend, report... Measure the impact exercise, bracing and partial body weight support treadmill training have on functional outcomes and to mitigate fall risk. Capture and analyze difficult gait such as: freezing, overlapping footfalls, walking walker tracks, quad canes and toe drags that other walkways cannot. In addition, PKMAS offers unique and standardized protocols: walking, turning, gait initiation, static balance, limits of stability. Primary Gait Screen and the Four Square Step Test. Please visit our booth to experience our best in class product knowledge in person!

Vicon delivers highly accurate 3D motion capture systems for use in gait analysis. Nearly 400 clinical gait labs worldwide use Vicon technology. Its flagship camera line, the Vicon Vantage, offers the highest resolution, frame rates and accuracy available, allowing detailed motion capture in almost any environment. Bonita is Vicon’s next-generation camera, combining size, power, and price performance into one amazing solution. Vicon was established in Oxford, UK, in 1984 and is now a subsidiary of the Oxford Metrics Group Plc. Some of Vicon’s global clients include Liverpool John Moores University, University of Vienna; Nuffield Orthopaedic Centre; University of Brussels; Northumbria University.

Vicon delivers highly accurate 3D motion capture systems for use in gait analysis. Nearly 400 clinical gait labs worldwide use Vicon technology. Its flagship camera line, the Vicon Vantage, offers the highest resolution, frame rates and accuracy available, allowing detailed motion capture in almost any environment. Bonita is Vicon’s next-generation camera, combining size, power, and price performance into one amazing solution. Vicon was established in Oxford, UK, in 1984 and is now a subsidiary of the Oxford Metrics Group Plc. Some of Vicon’s global clients include Liverpool John Moores University, University of Vienna; Nuffield Orthopaedic Centre; University of Brussels; Northumbria University.

Vicon Motion Systems Ltd  

ProtoKinetics offers The Premiere Gait Analysis System: Zeno Walkway powered by PKMAS software: Quantify, Track, Trend, Report... Measure the impact exercise, bracing and Partial Body Weight Support treadmill training have on functional outcomes and to mitigate fall risk. Capture and analyze difficult gait such as: freezing, overlapping footfalls, walking walker tracks, quad canes and toe drags that other walkways cannot. In addition, PKMAS offers unique and standardized protocols: walking, turning, gait initiation, static balance, Limits of Stability. Primary Gait Screen and the Four Square Step Test. Please visit our booth to experience our best in class product knowledge in person!

Vicon provides researchers with an objective measure of free-living lying, sedentary, upright and ambulatory activities. The activPAL4+ model includes a magnetometer and barometer in addition to the standard acceleration sensor allowing turning during stepping to be quantified as well as stair ascent. The activPAL is unique in being able to quantify time cycling and in car travel, providing the opportunity to understand mobility choices (active travel vs car). This gives the researcher previously unreported yet valuable insights into the context of free-living behaviours, providing the evidence to link health outcomes with physical behaviours.

The activPAL(tm) provides researchers with an objective measure of free-living lying, sedentary, upright and ambulatory activities. The new activPAL4+ model includes a magnetometer and barometer in addition to the standard acceleration sensor allowing turning during stepping to be quantified as well as stair ascent. The activPAL is unique in being able to quantify time cycling and in car travel, providing the opportunity to understand mobility choices (active travel vs car). This gives the researcher previously unreported yet valuable insights into the context of free-living behaviours, providing the evidence to link health outcomes with physical behaviours.

Vicon provides researchers with an objective measure of free-living lying, sedentary, upright and ambulatory activities. The activPAL4+ model includes a magnetometer and barometer in addition to the standard acceleration sensor allowing turning during stepping to be quantified as well as stair ascent. The activPAL is unique in being able to quantify time cycling and in car travel, providing the opportunity to understand mobility choices (active travel vs car). This gives the researcher previously unreported yet valuable insights into the context of free-living behaviours, providing the evidence to link health outcomes with physical behaviours.
THANK YOU TO OUR SUPPORTERS

SPONSORS

VICON

ELSEVIER

EXHIBITORS

AMTI

APDM

cometa

coda motion

DELSYS

GAITRite

Gaitup

MediTouch

Neurosoft

MoteK

PAL Technologies

PROTKINETICS

VICON