



access to sport

The new kid on the World Para Athletics block:  
The evidence for classification measures to be  
included in RaceRunning classification



Queen Margaret University  
EDINBURGH

Marietta van der Linden, Nicola Tennant, Orla Corrigan, Martine Verheul



# What is RaceRunning?



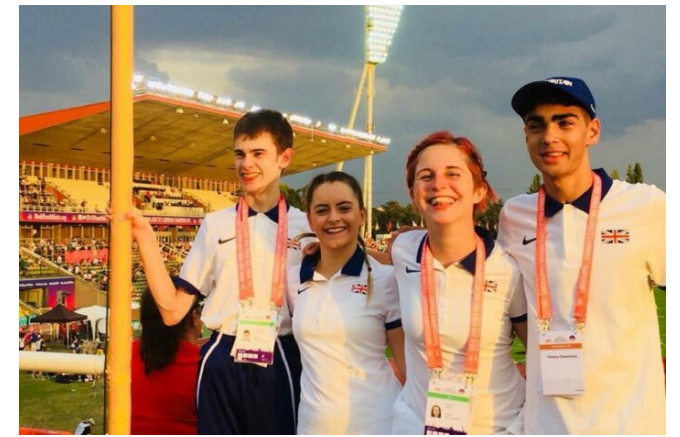
- Light weight 'trike' with chest support and without pedals
- Allows athletes with limited or no walking ability to propel themselves independently

- Expected health benefits which the majority may not experience from any other sport: cardiovascular & bone health





# RaceRunning history



- 1991: Connie Hansen designs first 'Petra bike' for Mansoor Siddiqi
- 2009 CPISRA develops RaceRunning classification (RR1,RR2,RR3)
- 2016-now: *RaceRunning research by RR research Scotland & CPISRA*
- 2017: RaceRunning accepted as an World Para Athletic event
- 2018/2019: 100m RaceRunning European and World para-athletic championships



Queen Margaret University  
CENTRE FOR HEALTH, ACTIVITY  
AND REHABILITATION RESEARCH



Human Performance Science Research  
Group



# 2016 data RaceRunning research Scotland

Gait & Posture 61 (2018) 362–367



Contents lists available at ScienceDirect

Gait & Posture

journal homepage: [www.elsevier.com/locate/gaitpost](http://www.elsevier.com/locate/gaitpost)



Full length article

The influence of lower limb impairments on RaceRunning performance in athletes with hypertonia, ataxia or athetosis



Marietta L. van der Linden<sup>a,\*</sup>, Sadaf Jahed<sup>a</sup>, Nicola Tennant<sup>b</sup>, Martine H.G. Verheul<sup>c</sup>

<sup>a</sup> Centre of Health, Activity and Rehabilitation Research, Queen Margaret University, Queen Margaret University Drive, Musselburgh EH21 6UU, UK

<sup>b</sup> RaceRunning Scotland, Glasgow, UK

<sup>c</sup> Human Performance Science Research Group, University of Edinburgh, Institute for Sport, Physical Education & Health Sciences, Holyrood Road, Edinburgh, EH8 8AQ, UK



Queen Margaret University  
CENTRE FOR HEALTH, ACTIVITY  
AND REHABILITATION RESEARCH



Human Performance Science Research  
Group



# Trunk control?

- Trunk control (TCMS [1]) strongest association with gait capacity in CP [2]
- Trunk impairment was the most important factor for tilting the chair and acceleration in wheelchair rugby athletes [3]

[1] Heyrman L, et al. Res Dev Disabil. 2011; 32:2624–35.

[2] Balzer J et al Disabil Rehabil. 2017; 24:1-7.

[3] Altmann VC, et al. Scand J Med Sci Sports. 2017; 27(9):1005-1014.



Queen Margaret University  
CENTRE FOR HEALTH, ACTIVITY  
AND REHABILITATION RESEARCH



Human Performance Science Research  
Group



# Research Questions



- What is the association between lower limb impairment measures & **trunk control** and RaceRunning speed over 100 and **200m**?
- Can cluster analysis being used to inform the number of classes?



# Demographics

- 13 males and 13 females
- Average age 24 (SD 7)
- Majority CP (24 out of 26)
- RaceRunning class:
  - ✓ RR1: 7
  - ✓ RR2: 9
  - ✓ RR3: 10
- RaceRunning experience : 4.3(3.1) years (range: 1-11)

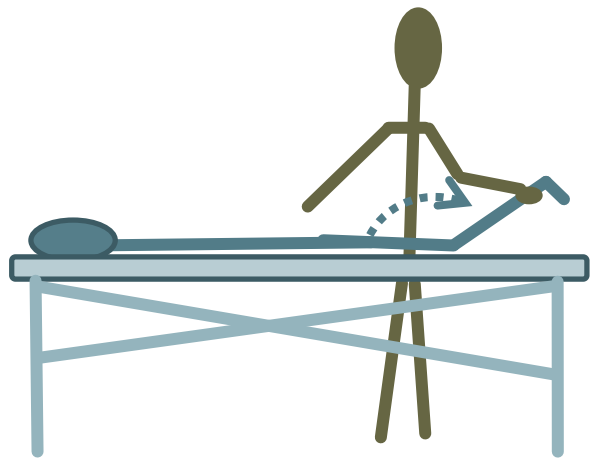


# Methods

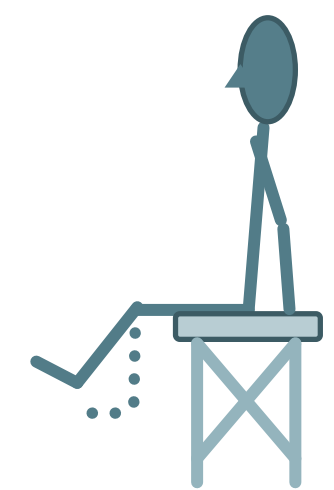
- Data collection 2017 Camp & Cup
  - Spasticity (ASAS & MAS), Selective Voluntary Motor Control (SCALE) and trunk control (TCMS)
- Fastest 100m and 200m
- Spearman's Rho
- K-means cluster analysis: for 3 and 2 clusters



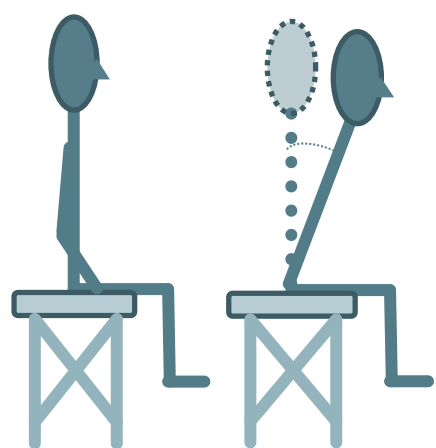




Spasticity



Selective voluntary motor control



Trunk Control

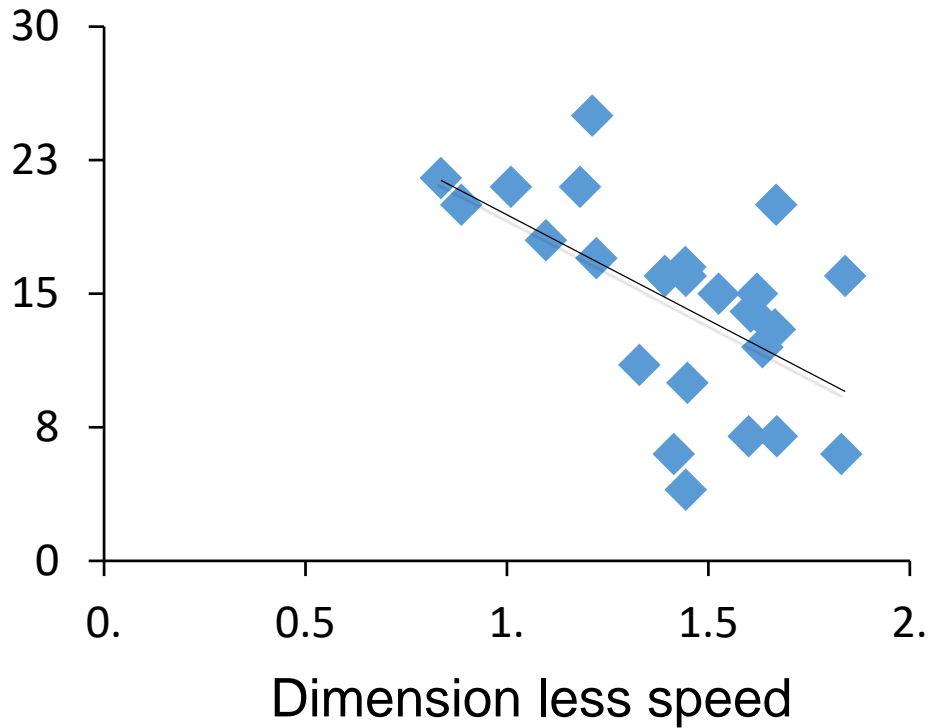
## Spearman correlation coefficients

	100m	200m	DL100mspeed
<i>MAStotal</i>	<b>.556**</b>	<b>.733**</b>	<b>-.566**</b>
<i>ASAStot</i>	<b>.647**</b>	<b>.798**</b>	<b>-.619**</b>
<i>SCALEtot</i>	<b>-.654**</b>	<b>-.741**</b>	<b>.619**</b>
<i>TRUNK Total 58</i>	<b>-.688**</b>	<b>-.737**</b>	<b>.708**</b>

\*\*\*p<0.01

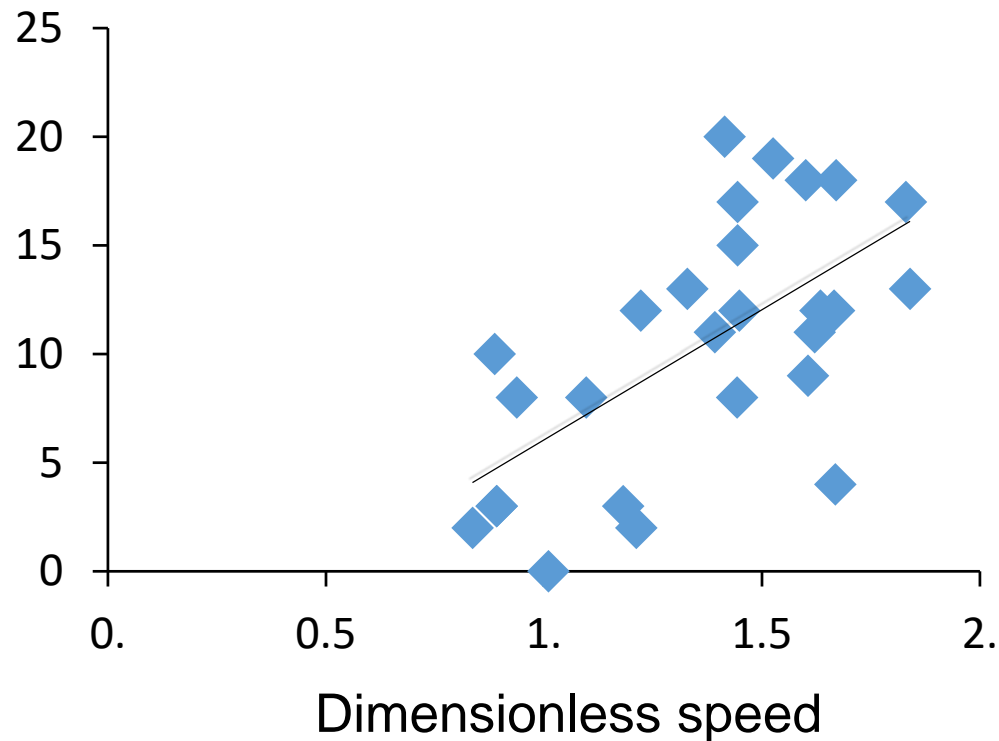
# 100 meter results.

## Total Spasticity (ASAS)



Bilateral scoring 0-4  
*Gastrocnemius*  
*Hamstrings*  
*Adductors*  
*Quadriceps*

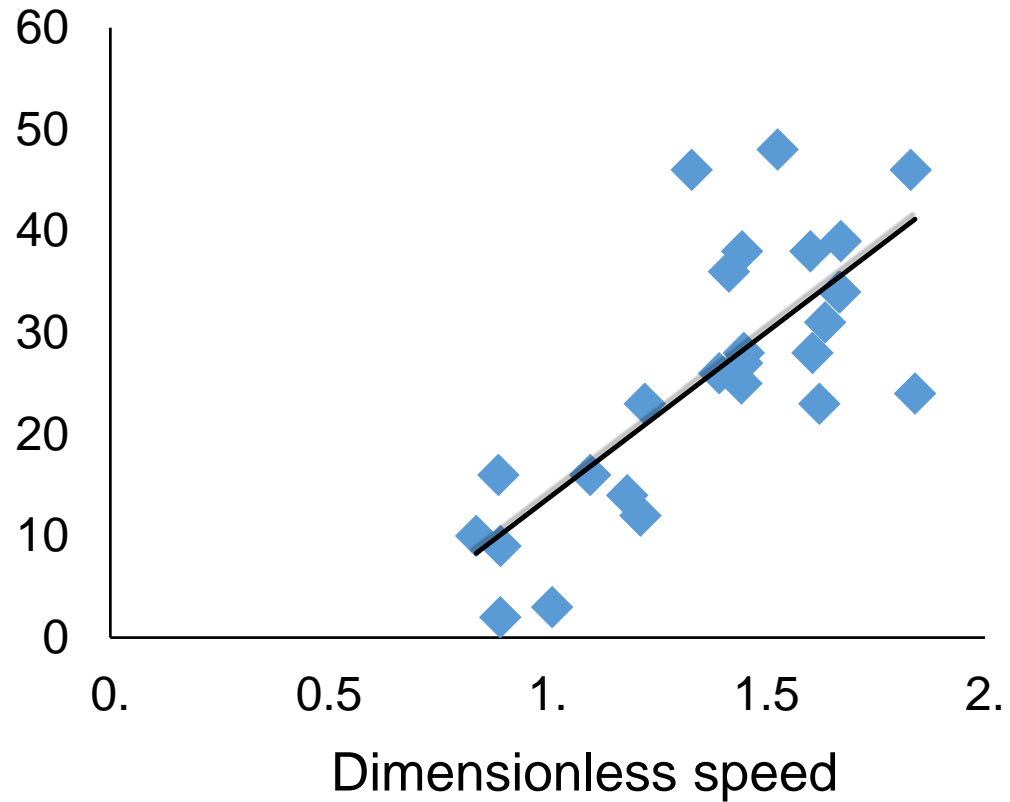
## Selective motor control (SCALE)



Bilateral scoring 0-2  
*Hip*  
*Knee*  
*Ankle*  
*Subtalar joint*  
*toes*

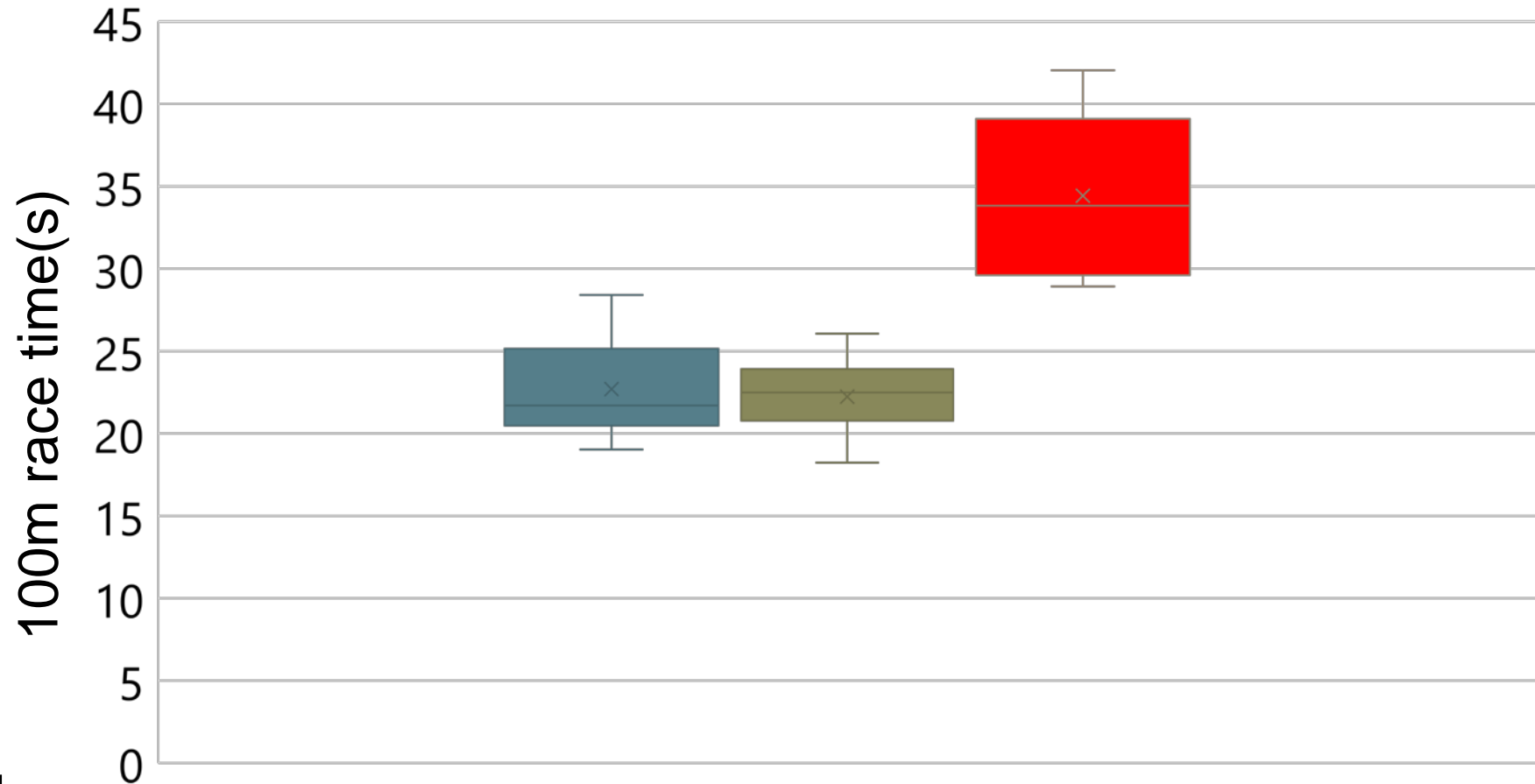
# 100 meter results.

Trunk control (TCMS)



Three components: *Static sitting balance, selective motor control, dynamic reach.* Total score ranges from 0-58 points

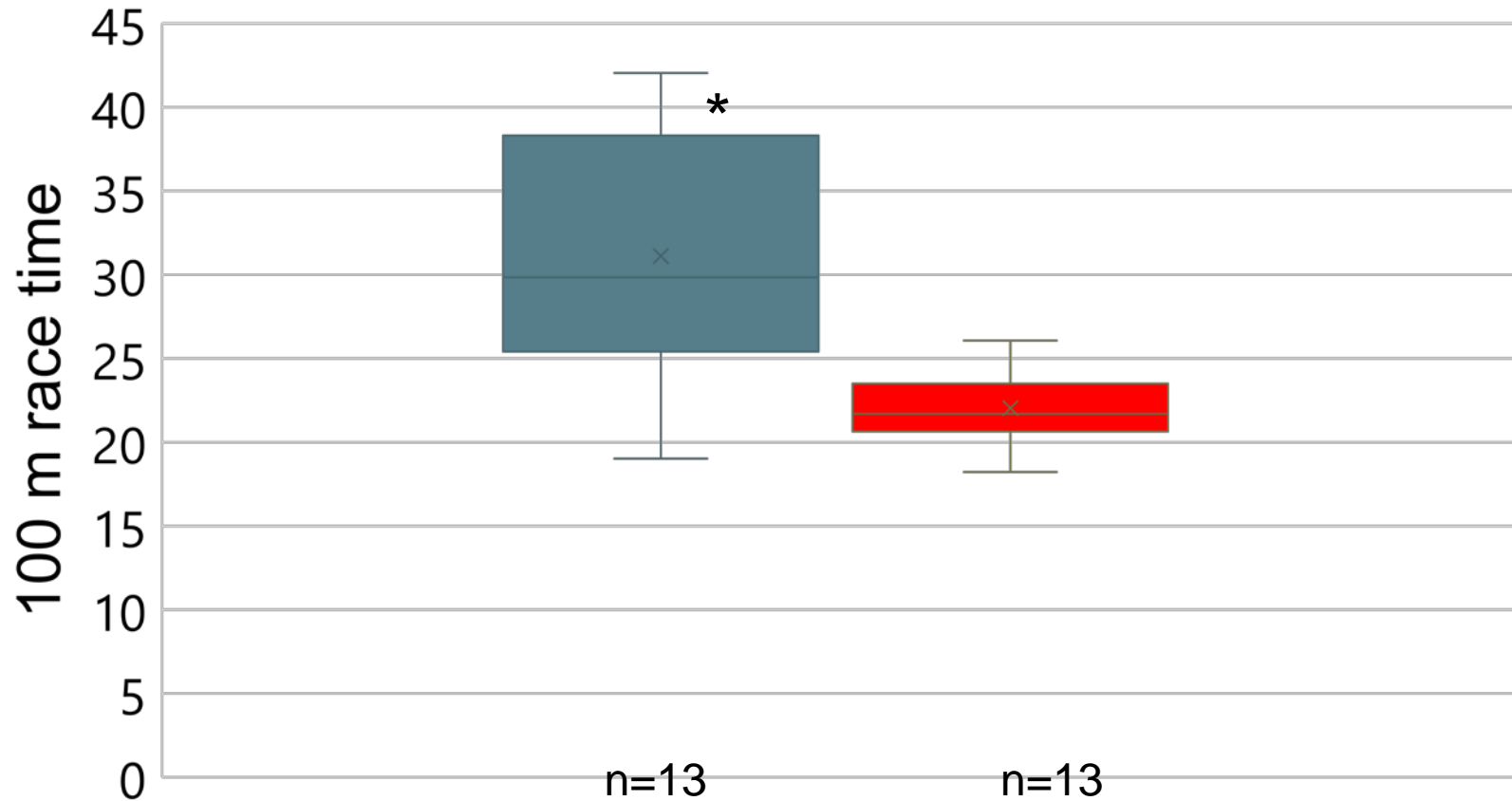
# K (3) means cluster with ASAS, SCALE, TCMS



\*p=0.001



# K (2) means cluster with ASAS, SCALE & TCMS



\*p=0.001



# Conclusions



- Statistically significant correlation between TCMS, SCALE, ASAS (and MAS) and 100m & 200m race time
- Cluster analysis indicated a favourable outcome for the two-cluster model



# BUT:



- Unknown/unclear effect of other coordination impairments such as presence of dystonia/athetosis, ataxia, upper limb involvement
- Unknown influence of confounding variables such as training status, presence of other impairment types (intellectual, vision)





# Ongoing & future research

- Ataxia & Dyskinesia specific measures
- Ratio scaled measures
- Minimum Impairment Criteria
- Performance measures (e.g. motion analysis)



# Thank you!



Queen Margaret University  
CENTRE FOR HEALTH, ACTIVITY  
AND REHABILITATION RESEARCH



Human Performance Science Research  
Group

