University of Queensland
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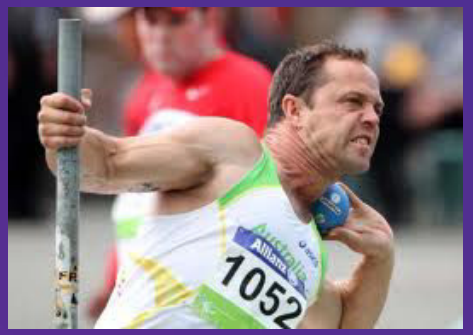
School of Human Movement Studies

Evaluating the validity of novel coordination tests for classification of throwers with Hypertonia, Ataxia and Athetosis



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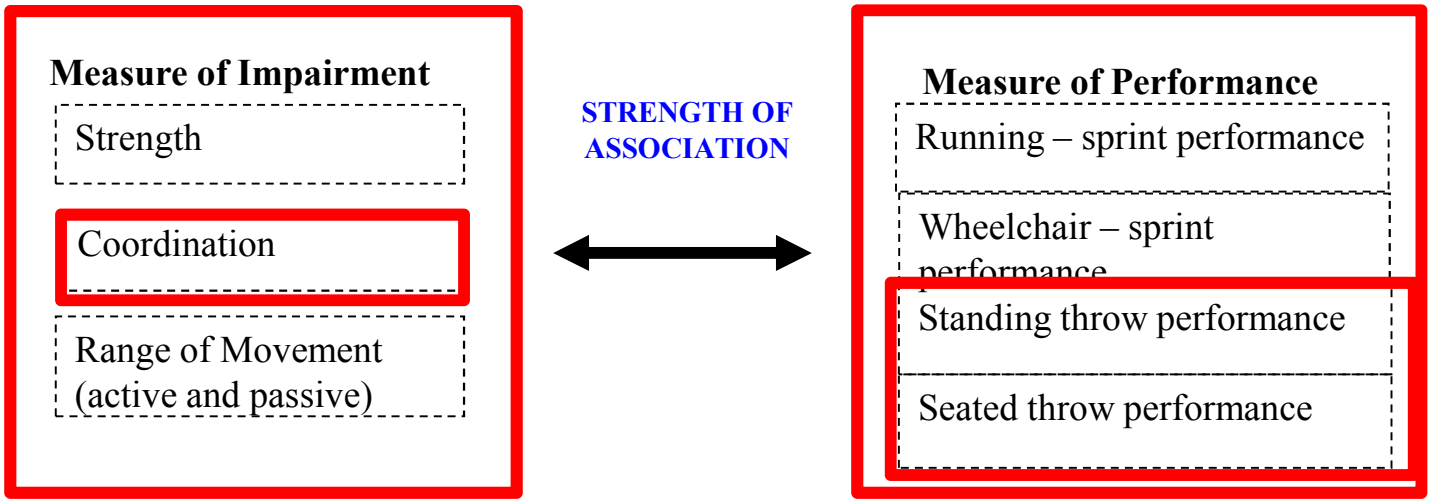
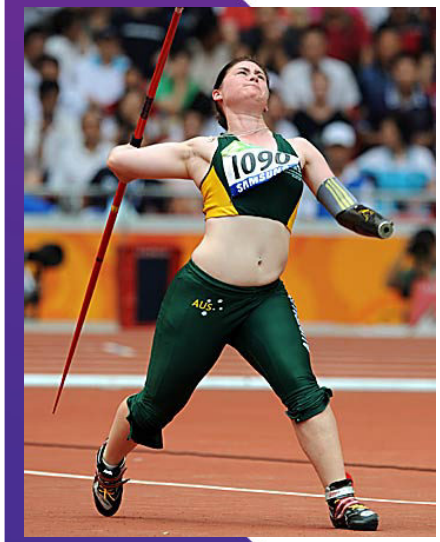
Background – Classification in Paralympic sport

- Evidence-based classification mandated by IPC – empirical evidence is required
- Purpose of classification
- Eligible impairment types



IPC Concept map – Athletics classification (Tweedy & Vanlandewijck, 2011)

Background – Throwing events



Motor coordination is the ability to execute fluid, accurate and controlled movements rapidly. This is achieved through sychronisation of muscles in organised patterns for a desired result.

- Paralympic impairment types that affect coordination
  - Hypertonia
  - Ataxia
  - Athetosis
- Paralympic throwing events consist of seated and standing
  - Javelin
  - Shot put
  - Discus
  - Club (seated only)

Aim

Evaluate the validity of novel coordination tests for classification of throwers with hypertonia, ataxia, and athetosis.

1. Determine whether AWD are significantly different from ND participants on coordination tests
2. Determine the strength of association between coordination tests and throwing performance in AWD

Methods - Participants

Participants

Athletes with Disabilities

n = 17 male (9 seated, 8 ambulant throwers)
Athletes: hypertonia, ataxia, athetosis
Mean age 25.21 (± 6.12) years

Non-disabled participants

n = 20 male
Regularly active in competitive sport
Mean age 22.33 (± 4.42) years

Methods - tests

Participants - tests

Athletes with Disabilities

Coordination tests

5 Upper limb (n = 16)

5 Lower limb (n = 8)

Throwing Performance tests

Seated with pole (n = 17)

Seated without pole (n = 16)

Ambulant (n = 8)

Non-disabled participants

Coordination tests

4 Upper limb (n = 20)

5 Lower limb (n = 20)

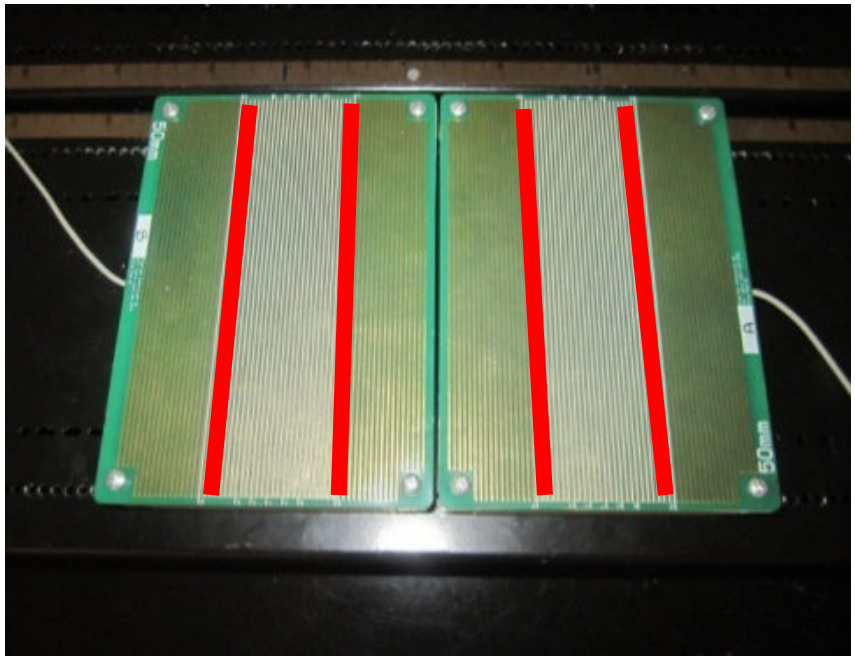
Methods – coordination tests

Features of coordination tests:

- Constrained or unconstrained
- Discrete aiming or reciprocal tapping
- In the sagittal or coronal plane

Outcome measures:

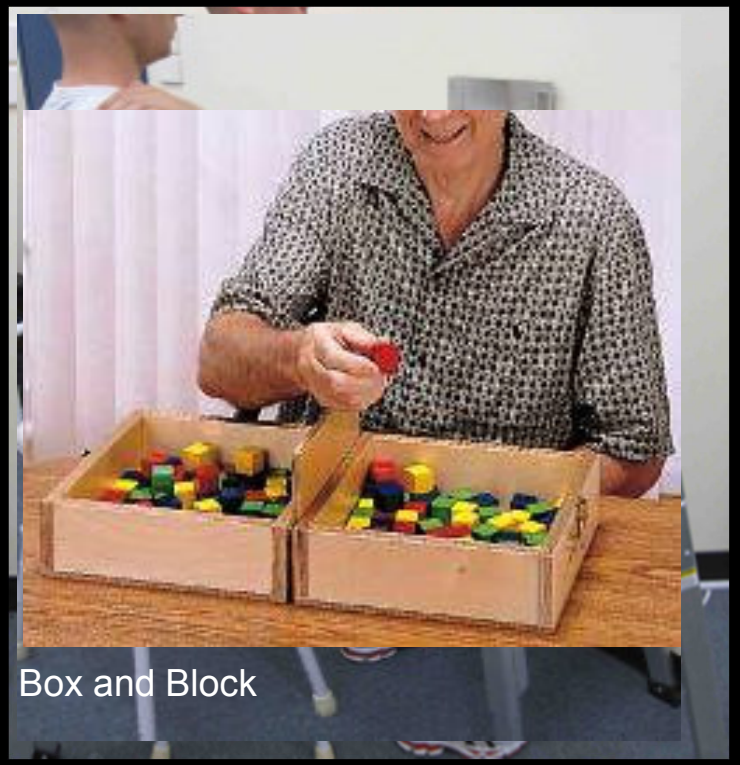
- Mean Movement Time (s)
- Number of blocks moved



Methods – coordination tests upper limb

Upper Limb Coordination Tests

- Discrete Sagittal constrained (s)
- Discrete Vertical constrained (s)
- Discrete Sagittal unconstrained (s)
- Discrete Vertical unconstrained (s)
- Box and Block throwing arm (Num blocks moved)



Sagittal plane discrete test*

Vertical plane discrete test

Methods – coordination tests lower limb

Lower Limb Coordination tests

- Unilateral constrained least affected limb (s)
- Unilateral constrained most affected limb (s)
- Unilateral unconstrained least affected limb (s)
- Unilateral unconstrained most affected limb (s)
- Bilateral reciprocal (s)

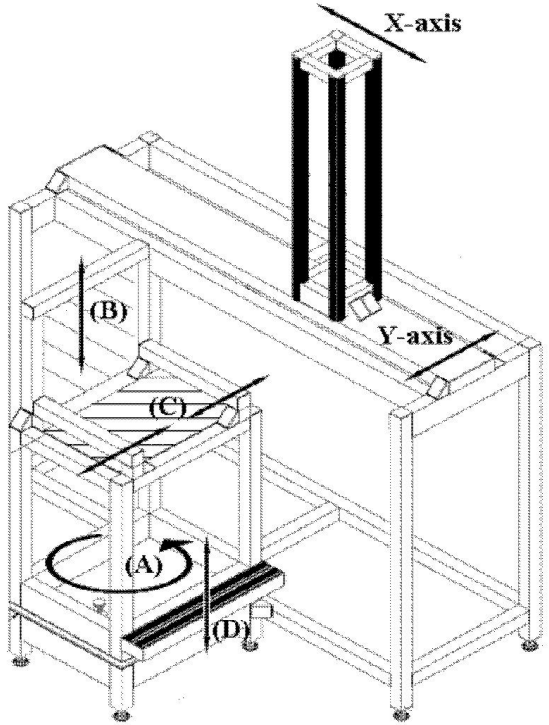
Ambulant Throw

Bilateral unconstrained

Methods – Throwing tasks

Throwing Performance - Distance (m)

- Seated with pole
- Seated without pole
- Ambulant



Conceptual Research Aim - IPC concept Map

Measure of Impairment

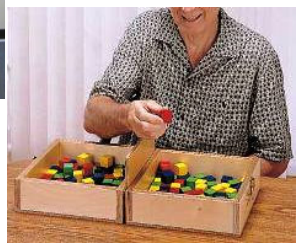
- Strength
- Coordination
- Range of Movement (active and passive)

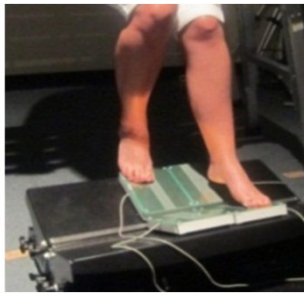
STRENGTH OF ASSOCIATION

- Running – sprint performance
- Wheelchair – sprint performance
- Standing throw performance
- Seated throw performance

IPC Concept map – Athletics classification (Tweedy & Vandlandewijck, 2011))







Methods

Statistical analysis

- **Independent t-test** Mean Movement Time (s) or number of blocks moved in 60sec for AWD and non-disabled athletes

- **Pearson's correlations** between tests of coordination and throw performance

- **Bivariate correlation matrix** to give an indication of how inter-related our measures were

Results – Independent T-Test

Coordination tests	Mean Movement Time (s)	
	AWD (±SD)	Non-disabled (±SD)
Discrete Sagittal constrained (s)	0.47 (0.22)	0.17 (0.04)**
Discrete Vertical constrained (s)	0.46 (0.23)	0.17 (0.03)**
Discrete Sagittal unconstrained (s)	0.46 (0.18)	0.17 (0.04)**
Discrete Vertical unconstrained (s)	0.46 (0.26)	0.17 (0.02)**
Unilateral constrained least affected limb (s)	0.64 (0.22)	0.31 (0.05)**
Unilateral constrained most affected limb (s)	0.80 (0.28)	0.33 (0.05)**
Unilateral unconstrained least affected limb (s)	0.47 (0.14)	0.27 (0.03)**
Unilateral unconstrained most affected limb (s)	0.68 (0.36)	0.28 (0.03)**
Bilateral reciprocal (s)	1.18 (0.57)	0.31 (0.05)**

**$p < 0.01$

Results – Seated Throw

Pearson's correlations (n = 16)

Upper limb Coordination Tests	Seated throw performance	
	With Assistive Pole	Without Assistive Pole
Discrete Sagittal constrained (s)	-0.56*	-0.52*
Discrete Vertical constrained (s)	-0.57*	-0.56*
Discrete Sagittal unconstrained (s)	-0.53*	-0.52*
Discrete Vertical unconstrained (s)	-0.57*	-0.58*
Box and Block throwing arm (Num of blocks moved)	0.59*	0.59*

*$p < 0.05$

Results – Ambulant Throw

Pearson's correlations (n = 8)

	Coordination tests	Ambulant Throw
Upper Limb	Discrete Sagittal constrained (s)	-0.53
	Discrete Vertical constrained (s)	-0.55
	Discrete Sagittal unconstrained (s)	-0.42
	Discrete Vertical unconstrained (s)	-0.50
	Box and Block throwing arm (Num. blocks moved)	0.81**
Lower Limb	Unilateral constrained least affected limb (s)	-0.39
	Unilateral constrained most affected limb (s)	-0.52
	Unilateral unconstrained least affected limb (s)	-0.23
	Unilateral unconstrained most affected limb (s)	-0.66
	Bilateral reciprocal (s)	-0.44

*p < 0.05 ** p < 0.01

Results – Bivariate correlations Upper Limb coordination tests (n = 16)

	Discrete Sagittal constrained	Discrete Sagittal Vertical	Discrete Sagittal unconstrained	Discrete Vertical unconstrained	Box and Block (Num of Blocks moved)
Discrete Sagittal constrained (s)	1	0.96**	0.96**	0.87**	-0.89**
Discrete Sagittal Vertical (s)	0.96**	1	0.90**	0.96**	-0.84**
Discrete Sagittal unconstrained (s)	0.96**	0.90**	1	0.83**	-0.82**
Discrete Vertical unconstrained (s)	0.87**	0.96**	0.83**	1	-0.72**
Box and Block (Num of Blocks moved)	-0.89**	-0.84**	-0.82*	-0.72**	1

*p < 0.05 ** p < 0.01

Results – Bivariate correlations Lower Limb coordination tests (n = 8)

	Unilateral constrained least affected limb (s)	Unilateral constrained most affected limb (s)	Bilateral reciprocal (s)	Unilateral unconstrained least affected limb (s)	Unilateral unconstrained most affected limb (s)
Unilateral constrained least affected limb (s) N = 8	1	0.90**	0.27	0.94**	0.67
Unilateral constrained most affected limb (s) N = 8	0.90**	1	0.28	0.75*	0.76*
Bilateral reciprocal (s) N = 8	0.27	0.28	1	0.10	0.73*
Unilateral unconstrained least affected limb (s) N = 8	0.94**	0.75*	0.10	1	0.62
Unilateral constrained most affected limb (s) N = 8	0.67	0.76*	0.73*	0.62	1

*p < 0.05 ** p < 0.01

Discussion

- AWD performed **slower** than non-disabled participants on all coordination tests
    - Bilateral reciprocal tapping test - complex
- Seated throw performance **significantly correlated** to all upper limb coordination tests
    - Box and block and Discrete vertical test
- Ambulant throw performance
    - Box and block – release critical to performance
    - Unilateral unconstrained most affected limb
- Upper limb tests of coordination were inter-related
    - Reduce number of tests

Conclusion

This study preliminary indication of valid tests of coordination for classification of throwers with hypertonia, ataxia and athetosis

Future Research

- Evaluate relationship between coordination tests and throwing performance in non-disabled participants

Other impairments of interest

- Impaired Strength
- Impaired Range of Movement

Thank you

Comments or questions…