Defining key joints for performance in va'a paddling

Step 1 in creating a sport-specific evidence-based classification system for para-va'a

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Para-va'a

- Outrigger
- Originates from P
- Ama and single bl
- 200 m flatwater

TOKYO 2020
PARALYMPIC GAMES

Pictures by Balint Vekassy ICF

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Para-va'a classification system

VL1

VL2

VL3

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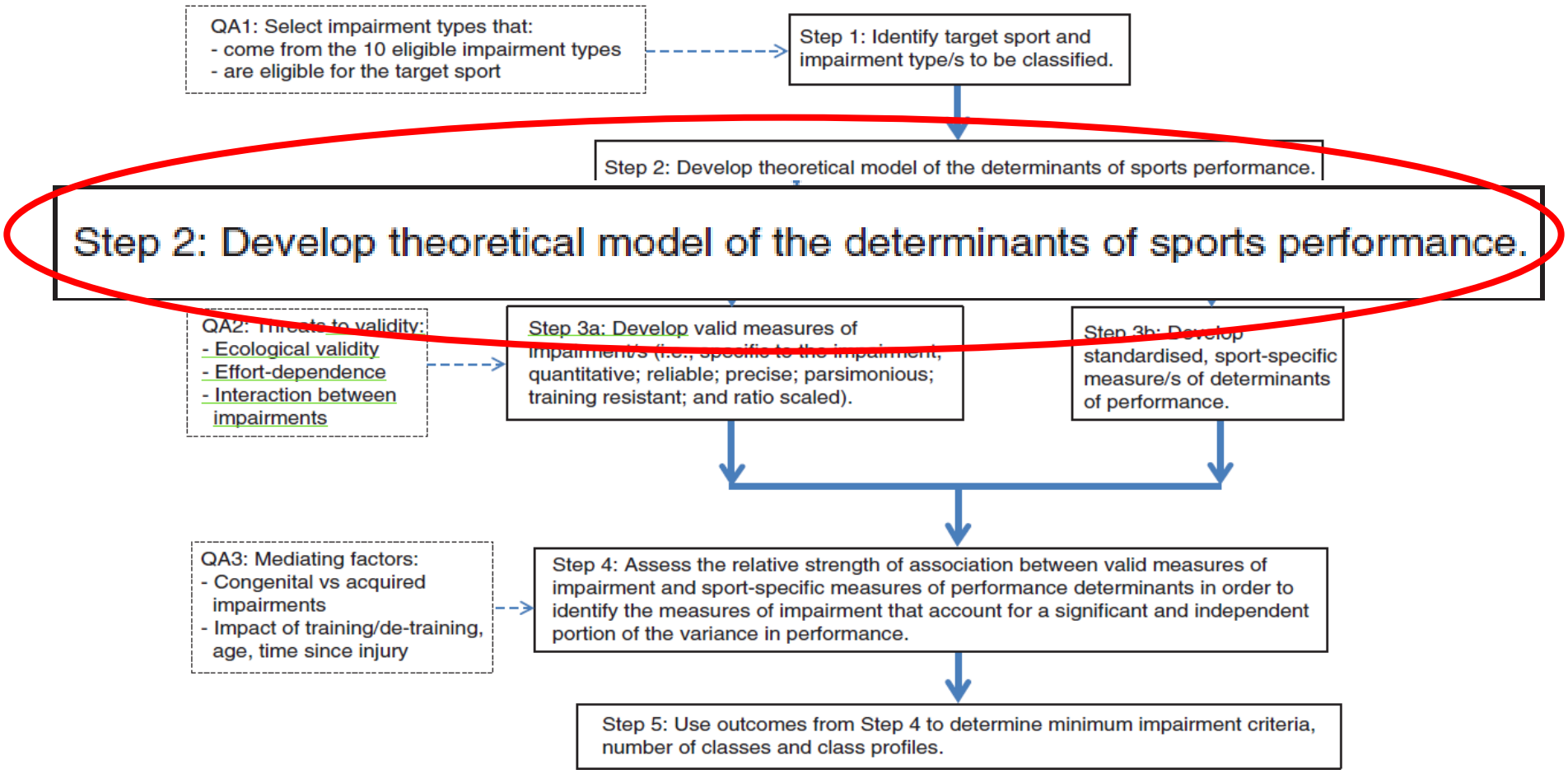

Diagram from Tweedy, Mann & Vanlandewijck 2016
in the book *Training and Coaching the Paralympic Athlete*

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Purposes

- To define the key joints for performance in va'a paddling by:
  - defining ROM of the trunk and lower limbs in elite able-bodied va'a athletes and para-va'a athletes during va'a ergometer paddling.
  - examining which joint angles are correlated with mean paddling force for able-bodied va'a athletes and para-va'a athletes; males and females separately.

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Method - participants

- 10 elite international level able-bodied va'a athletes from USA

  (5 F and 5 M; 44 ± 3 years, 75 ± 8 kg, 1.78 ± 0.1 m)

- 44 elite para-va'a athletes from 15 different countries from six continents

  (13 F and 31 M; 35 ± 8 years, 72 ± 17 kg, 1.73 ± 0.17 m)

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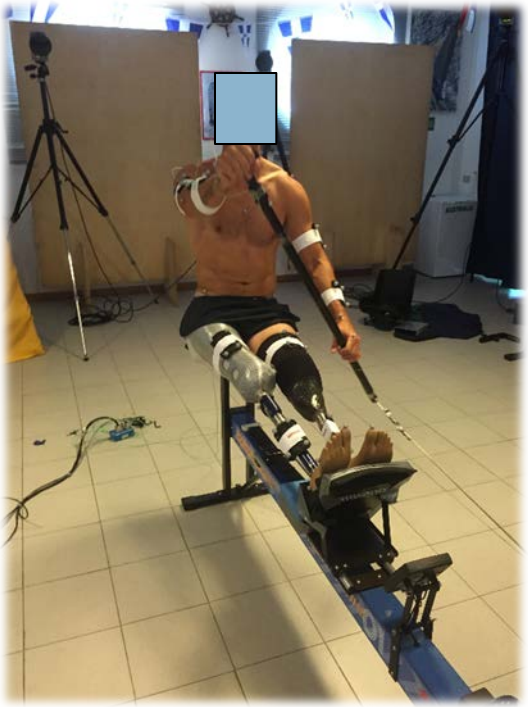
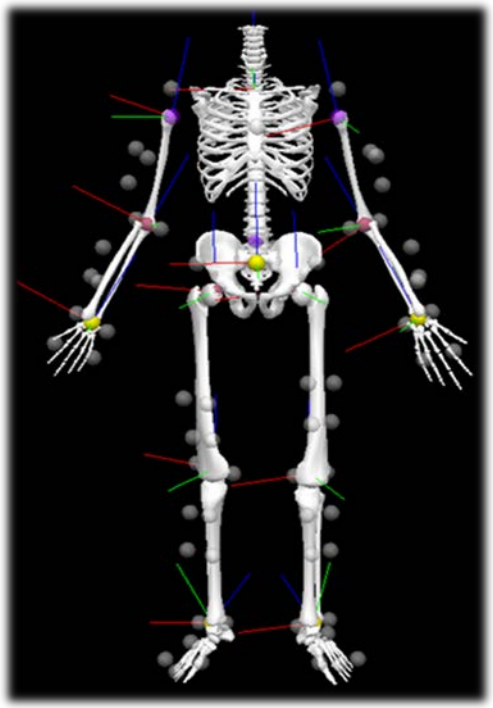
Method - 3D kinematics





- 12-camera 3D optoelectronic system (Oqus 4, Qualisys)
- 39-64 reflective markers
- Whole-body model consisting of 8-14 segments

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Method - kinetics

•1 piezoelectric force transducer (Kistler)

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Method - test protocol on ergometer

- Warm-up

- High intensity, i.e. the highest level that the athlete could stably maintain during 20 stroke cycles.

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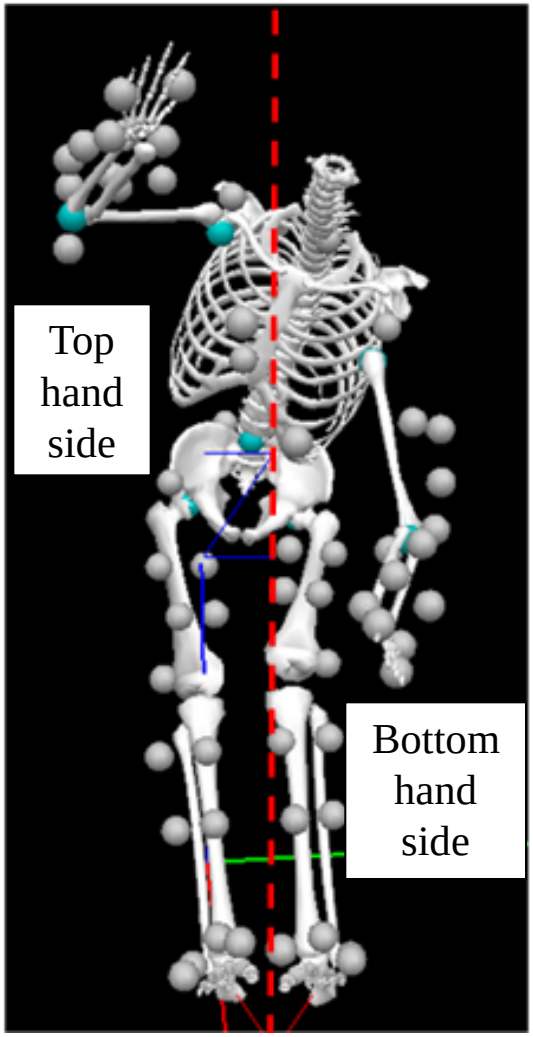
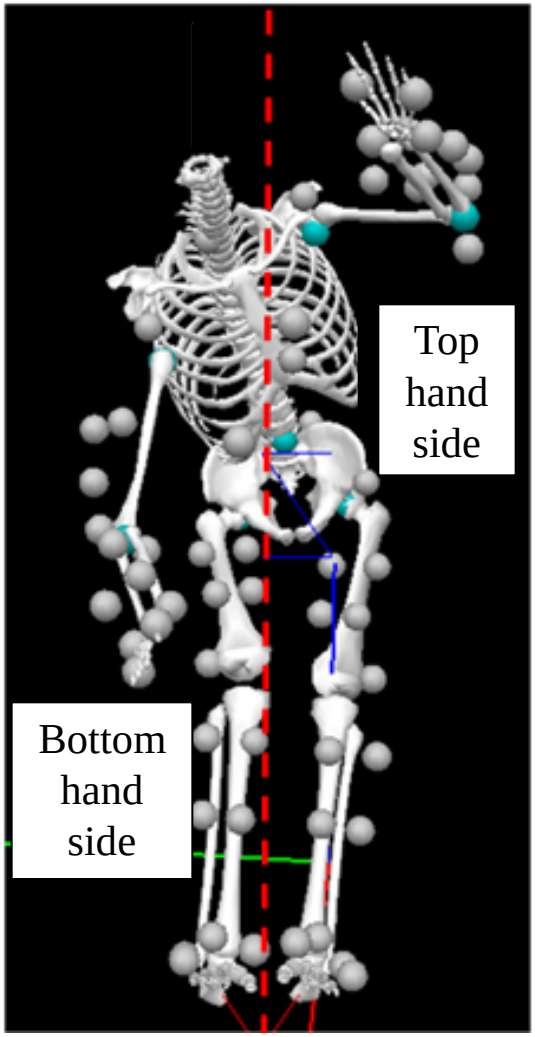
Method - data analyses





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Method - statistical analyses

- Pearson’s and Spearman Rho’s correlation coefficient
- All results were considered to be significant when $p \leq 0.05$.

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RESULTS

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Trunk angles for able-bodied va'a athletes

		Mean (°)	SD (°)
Trunk	Flexion (maximum)	31	14
	Flexion (minimum)	15	11
	ROM	**16**	
	Rotation (inc. pelvis) (catch)	27	9
	Rotation (inc. pelvis) (release)	20	9
	ROM	**47**	
	Rotation (catch)	18	12
	Rotation (release)	15	6
	ROM	**33**	

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Lower limb angles for able-bodied va'a athletes

		Top hand side		Bottom hand side	
		Mean (°)	SD (°)	Mean (°)	SD (°)
Hip	Flexion (maximum)	127	13	125	13
	Flexion (minimum)	104	9	105	11
	ROM	**23**		**20**	
Knee	Flexion (maximum)	55	7	51	9
	Flexion (minimum)	43	8	31	9
	ROM	**12**		**20**	
Ankle	Flexion (dorsi)	-19	9	-23	10
	Flexion (plantar)	27	9	35	11
	ROM	**8**		**12**	

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Correlations between force and joint angles

		Males		Females	
		r-value	*p*-value	r-value	*p*-value
Trunk	Trunk flexion A_{Max}	0.677*	<0.001	0.798	<0.001
	Trunk flexion A_{Min}	0.606*	<0.001	0.811	<0.001
	Trunk flexion ROM	0.449*	0.007	0.638	0.006
	Trunk and pelvis rotation ROM	0.687*	<0.001	0.562	0.019
	Trunk rotation ROM	0.546*	0.001	0.637	0.006
Lower limbs top hand side	Hip flexion A_{Max}	0.611	<0.001	0.667	0.003
	Hip flexion A_{Min}	0.435	0.009	0.515	0.034
	Hip flexion ROM	0.584	<0.001	0.654	0.004
Lower limbs bottom hand side	Hip flexion A_{Max}	0.585	<0.001	0.648	0.005
	Hip flexion A_{Min}	0.461	0.005	0.509	0.037
	Hip flexion ROM	0.486	<0.001	0.674	0.003
	Knee flexion ROM	0.542	0.001	0.504	0.039
	Ankle flexion ROM	0.370	0.026	0.735	0.001

*Pearsons correlation coefficient

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Conclusion

- The physical assessment in the new classification system should include tests of trunk and leg muscle function and can be done in sport specific ROM.

- The sport specific ROM values can be derived from the results from this research study.

- Being able move the trunk in flexion and extension, rotating the trunk and pelvis and moving the bottom hand side leg correlates with a higher mean paddling force.

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Acknowledgements

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THANK YOU

for your attention

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