The Impact of Physical Impairment on Motor Proficiency in Para-footballers

EVIDENCE-BASED CLASSIFICATION IN PARALYMPIC SPORT

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Historical Overview: Research Problem

Stoke Mandeville Games

1948

Seoul Paralympic Games

'88 SEOUL PARALYMPICS

1988

Barcelona Paralympic Games

1992

IPC´s Classification Strategy

IPC

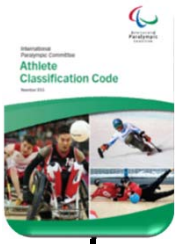
Classification Strategy

2003

Classification Code

2007

Athlete´s Classification Code



2015

Model of Best Practices

2017

Medical Classificat

1978

CPISRA

access to sport

2015

CP FOOTBALL

Reina & Vilanova-Périz (2017; adapted from Hart, 2016)

Historical Overview: The Cut-point Problem

+

SEVERITY OF IMPAIRMENT -- ACTIVITY LIMITATION

-

NE

C8

C5 C6 C7

C4

C3

C2

C1

FT5

FT8

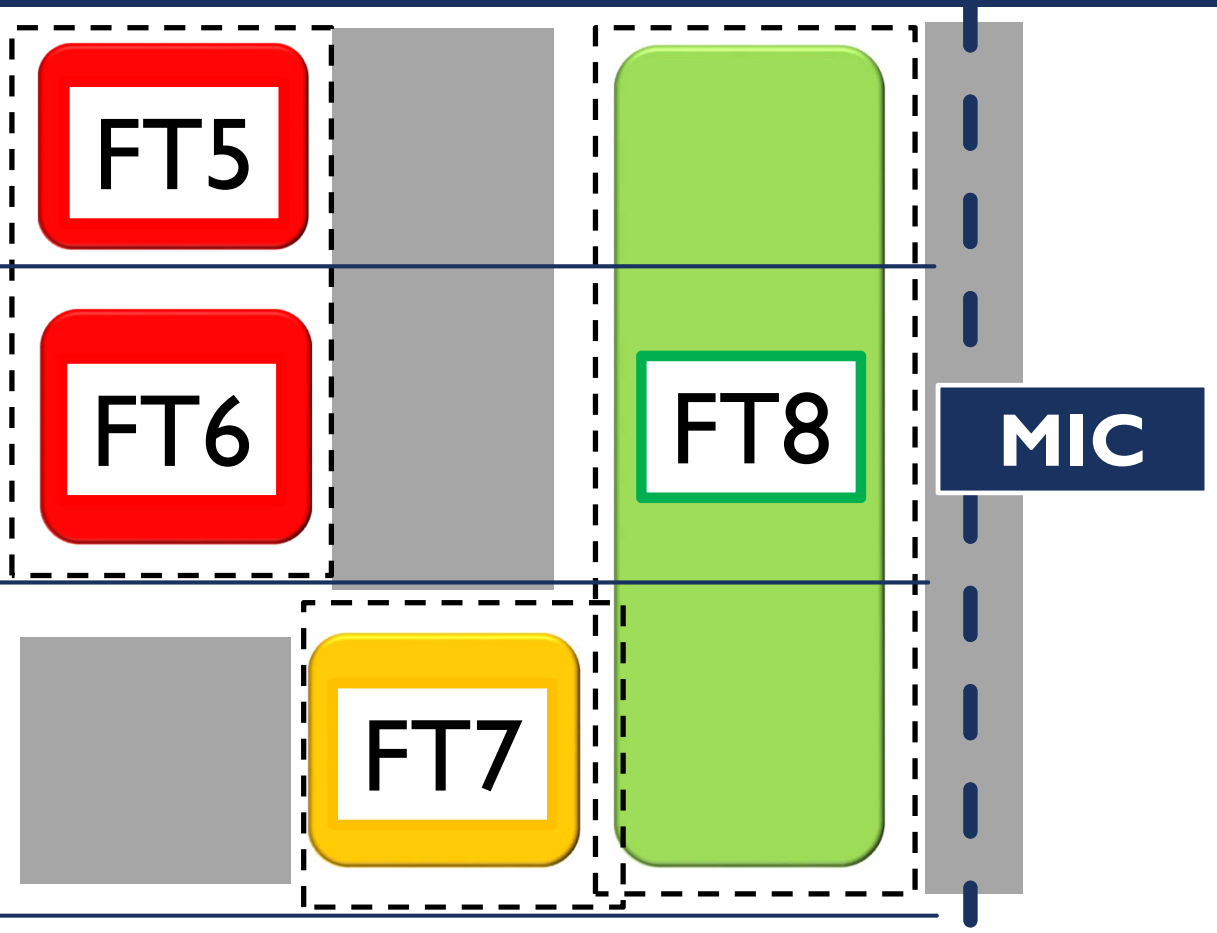
FT6 FT7

“Grey Areas” of the Current Classification System

A = Bilateral Spasticty

B = Athetosis / Ataxia

C = Unilateral Spasticity

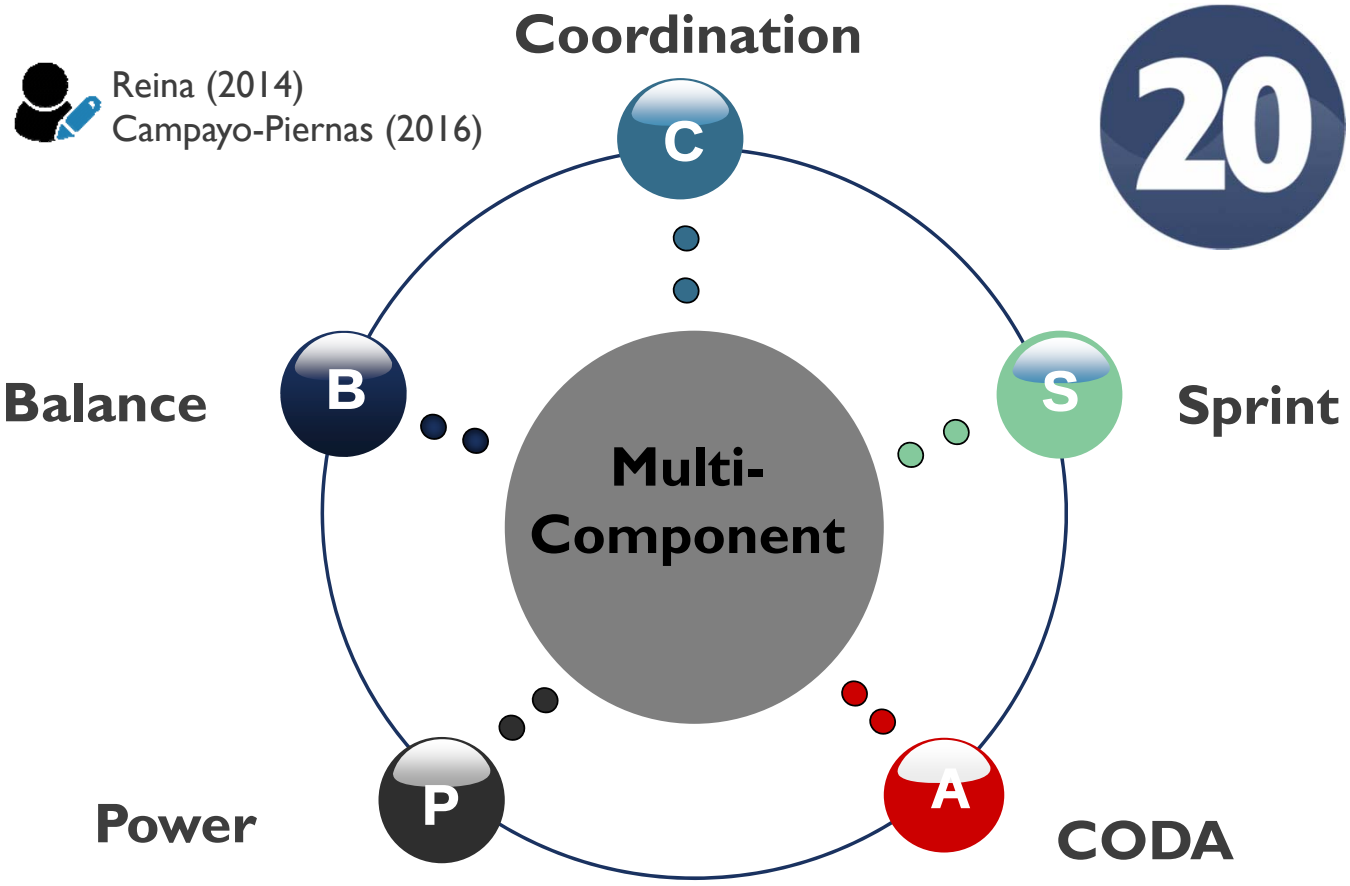


Reina (2016)

- How can Decision-Making be Improved?

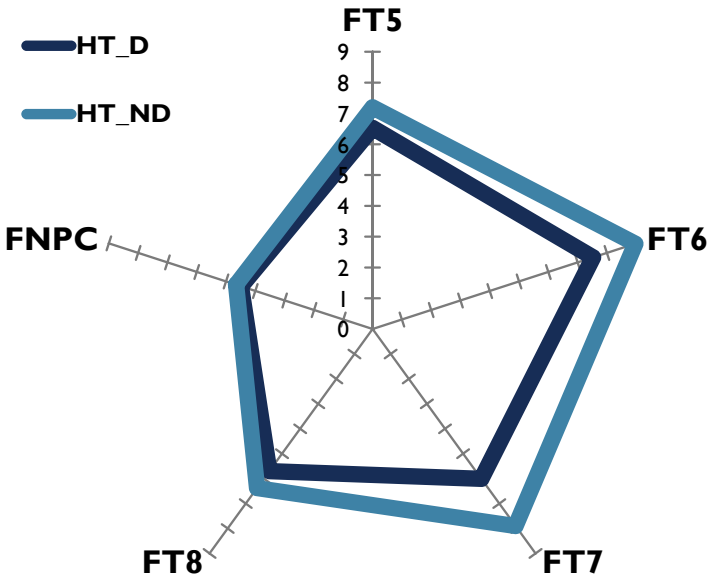
Performance Parameters in CP-Football

Reina (2014)
Campayo-Piernas (2016)



Performance Differences: e.g. Coordination Testing

Rapid Heel-Toe (s)



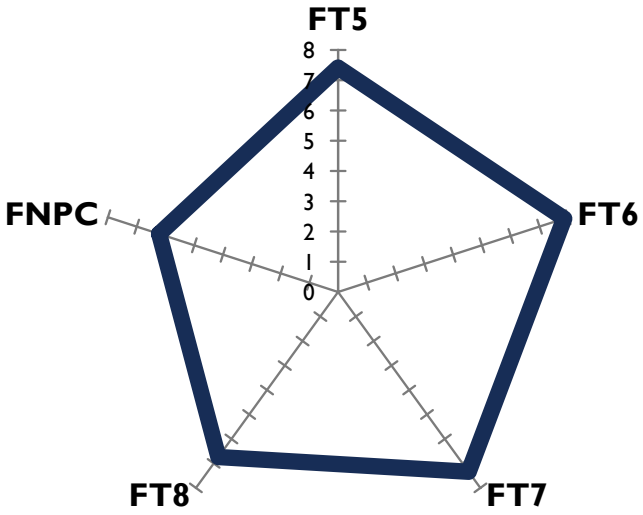
D

$p < .001$
$d = 1.34$
% Δ= 38.75

$p < .001$
$d = 1.85$
% Δ= 66.74

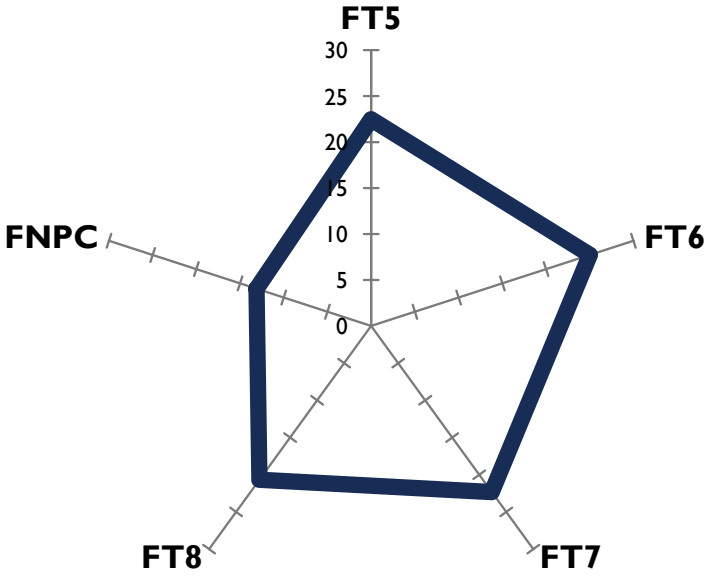
ND

Running in Place (s)



$p < .001$
$d = 0.98$
% Δ= 17.36

Split Jumps (s)



$p < .001$
$d = 2.01$
% Δ= 71.17

Campayo-Piernas (2016)

Activity Limitation Observation Categories

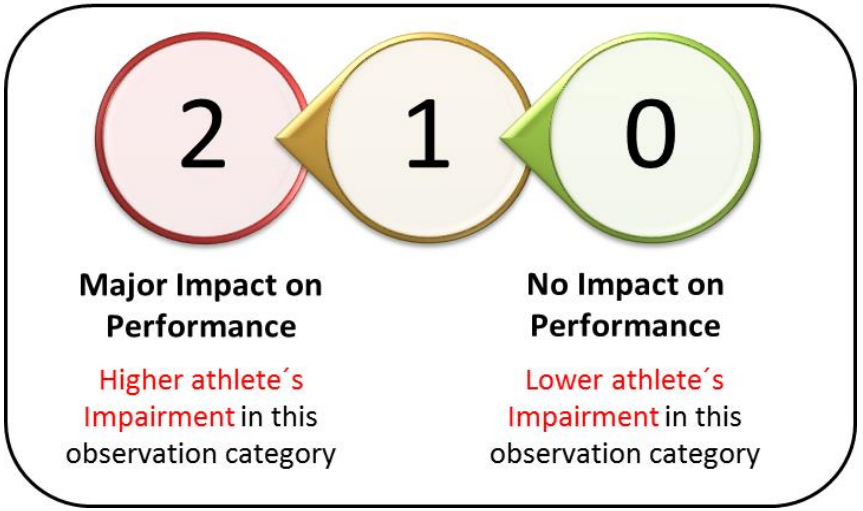
C **a. *Coordination,*** defined as the ability to voluntarily execute fluid, accurate movements rapidly.

B **b. *Balance,*** defined as the ability to maintain the line of gravity (vertical line from centre of mass) of a body within the base of support with minimal postural sway.

S **c. *Symmetry,*** *defined as the* correspondence and/or movement similarity on opposite sides of a dividing line or plane.

R **d. *Range of movement*,** defined as the full movement or optimal potential of a joint, usually its range of flexion and extension.

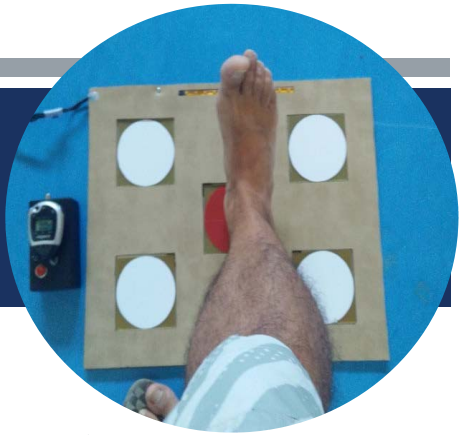
A **e. *Arm impairment*,** defined as the contribution of the arms to perform the whole movement.



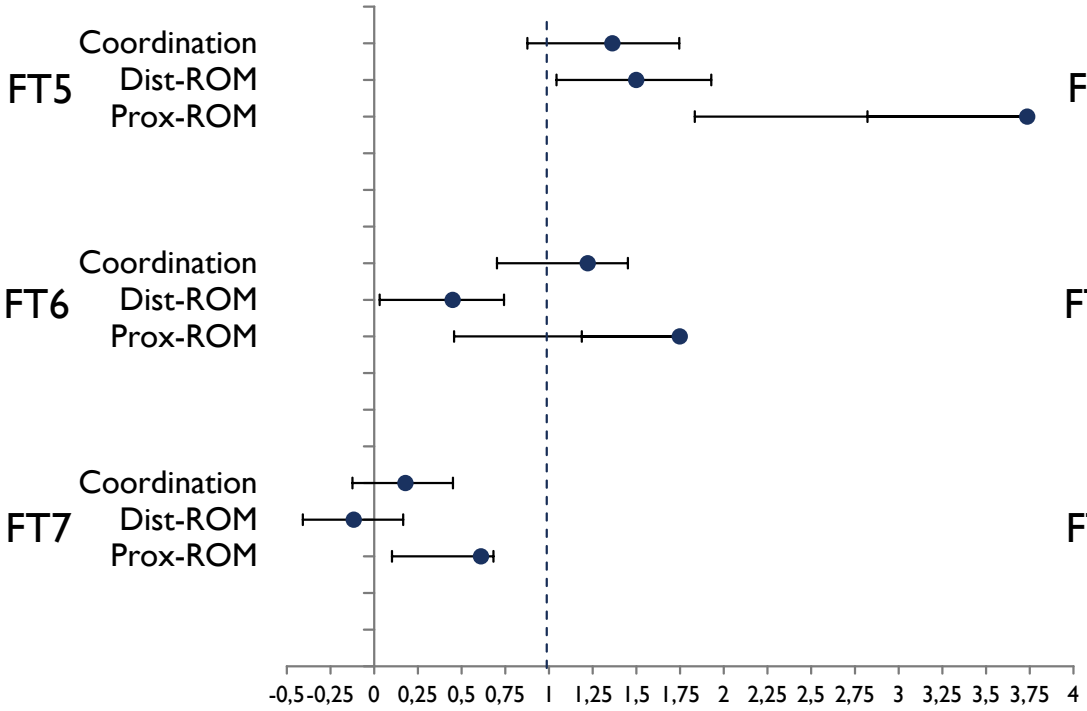
Project supported by:
AGITOS Foundation

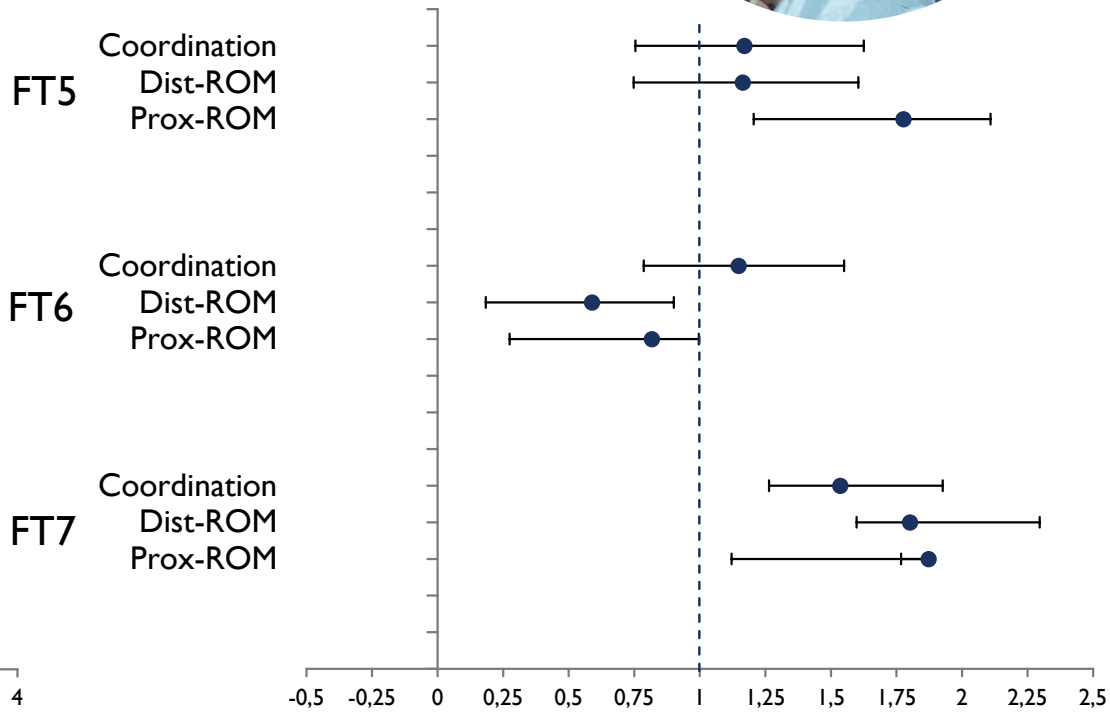
Reina, R., Sarabia, J., Sánchez, A., Beckman, E., Connick, M., & Tweedy, S. (2015)

Decision-Making using Effect Sizes



Dominant Side vs Non-Dominant Side





Reina, R., Gómez, G., Sarabia, J., Roldán, A., & Tweedy, S. (in process)

Rhea (2004)

Qualitative Analysis of Activity Limitation

- Limited ROM in hips (needed to turn the whole body.
- Poor dynamic running pattern (particularly when running backward)
- Presence of scissor running pattern:
  - Hip and knee flexion
  - Hip adduction and internal rotation
- Performance:
  - Difficulty for stopping and accelerating
  - Difficulty assisting movements of the upper limbs when running
- Poor agility level.

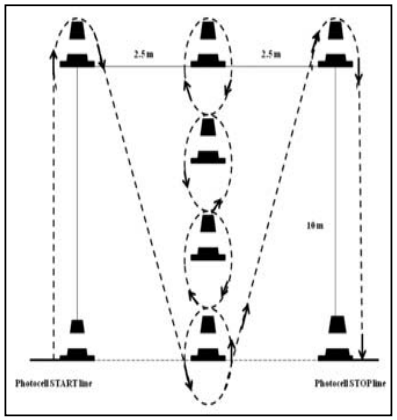
IFCPF (2017)

- What determines Proficiency in Para-footballers?

Testing for Evidence-Based Classification

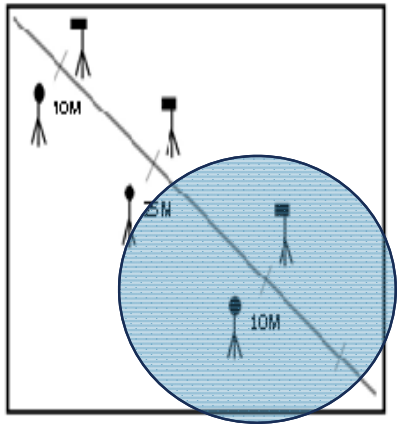
- **Data Envelopment Analysis (DEA):**
  - Classification tool.
  - Study the relative efficiency of some "Decision Making Units" (DMUs) using several inputs to produce several outputs.
  - DEA provides useful benchmarking information that can improve performance of inefficient DMUs

Charness et al. (1978)



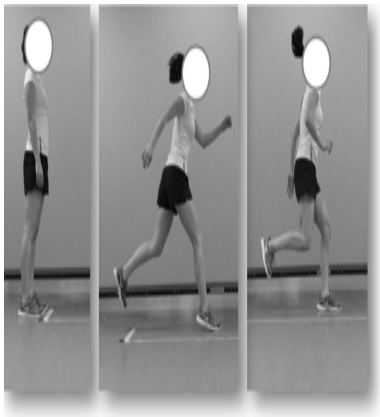
Illinois with Ball

Reina et al. (2016)



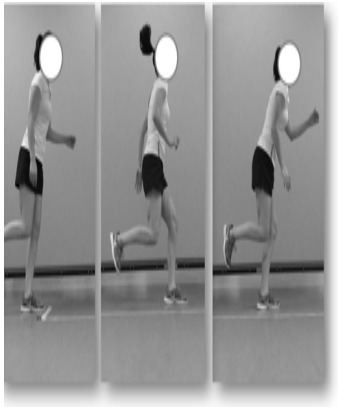
10m with Ball

Beckman & Tweedy (2009)**



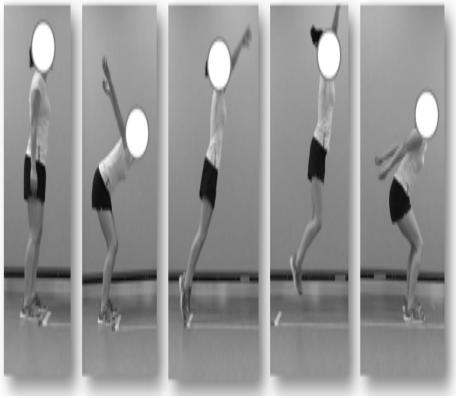
4 Bounds

Beckman & Tweedy (2009)



Triple Hop - ND

Munro & Herrington (2011)



Standing Broad Jump

Cámara et al. (2013)

DMU´s Outcomes

	X1	X2	Y1	Y2	Y3
DMU Code	ILLINOIS_BALL	TP_10BALL	TH_ND	4Bounds	SBJ
C1U4	28.14	2.32	2.16	2.99	1.19
C1U5	30.61	2.95	1.65	2.96	0.92
C1U8	22.64	2.54	1.04	2.58	0.53

8 FT8 players ranked in the first 14´s

Reina, R., Pastor, D., Campayo-Piernas, M., & Pastor, J.T. (in process)

frontiers in Physiology

ORIGINAL RESEARCH
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Change of Direction Ability Performance in Cerebral Palsy Football Players According to Functional Profiles

Raúl Reina[1], Jose M. Sarabia[1], Javier Yanci[2], María P. García-Vaquero[1] and María Campayo-Piernas[1]*

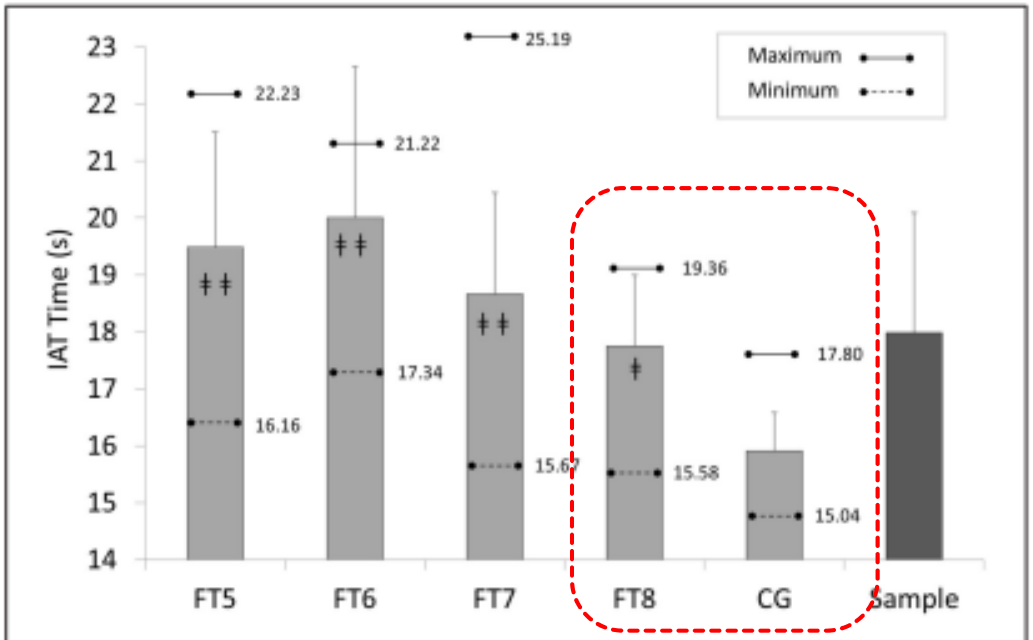


FIGURE 3 | Descriptive scores for each group in Illinois Agility test (IAT): FT5, FT6, FT7, and FT8, Football Players with Cerebral Palsy Classes; CG, control group; ǂǂ, CG vs. FT5, FT6, or FT7, $p < 0.001$; ǂ, CG vs. FT8, $p < 0.01$.

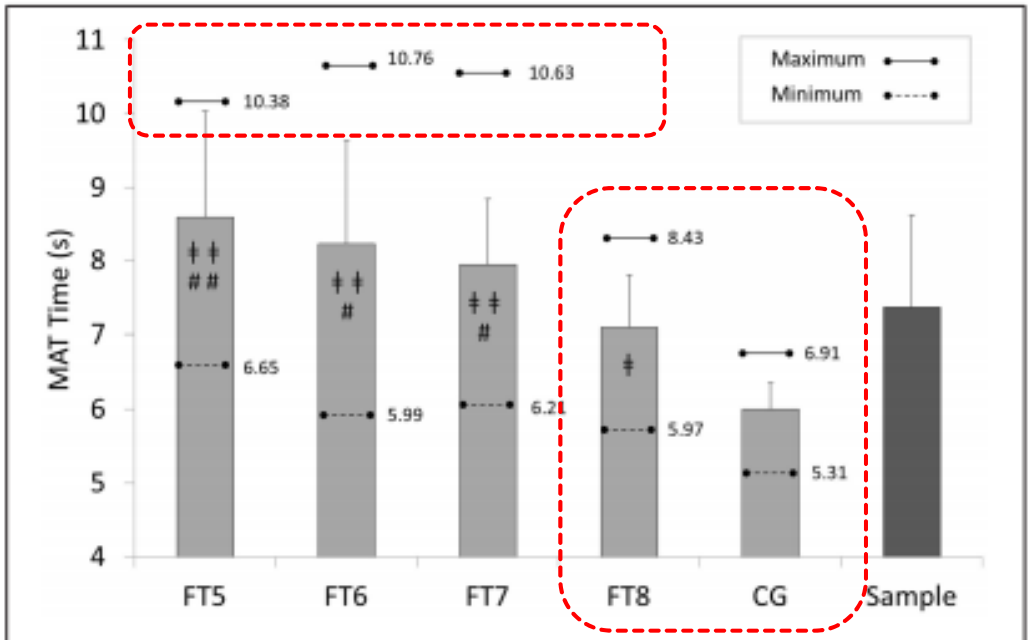


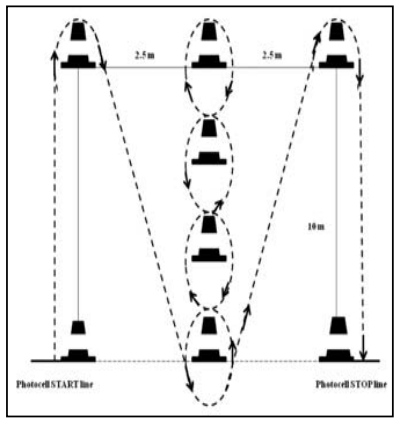
FIGURE 4 | Descriptive scores for each group in Modified Agility test (MAT); FT5, FT6, FT7, and FT8, Football Players with Cerebral Palsy Classes; CG, control group; ǂǂ, CG vs. FT5, FT6, or FT7, $p < 0.001$; ǂ, CG vs. FT8, $p < 0.01$; ##, FT8 vs. FT5, $p < 0.01$; #, FT8 vs. FT6-FT7, $p < 0.05$.

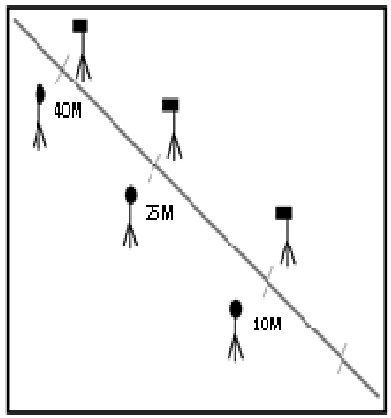
N 82

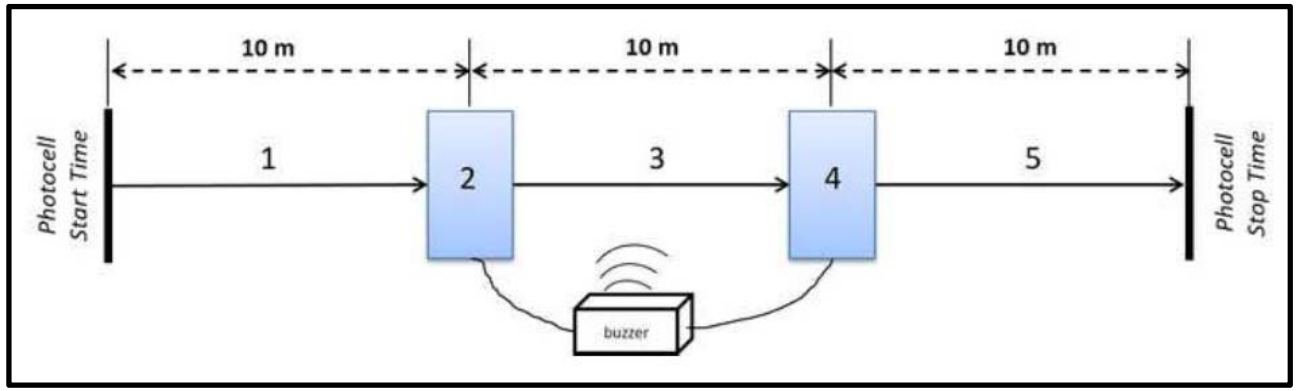
PLOS ONE

How does the ball influence the performance of change of direction and sprint tests in para-footballers with brain impairments? Implications for evidence-based classification in CP-Football

--Manuscript Draft--







Stop & Go (with and without the ball)

Within-Groups Comparisons

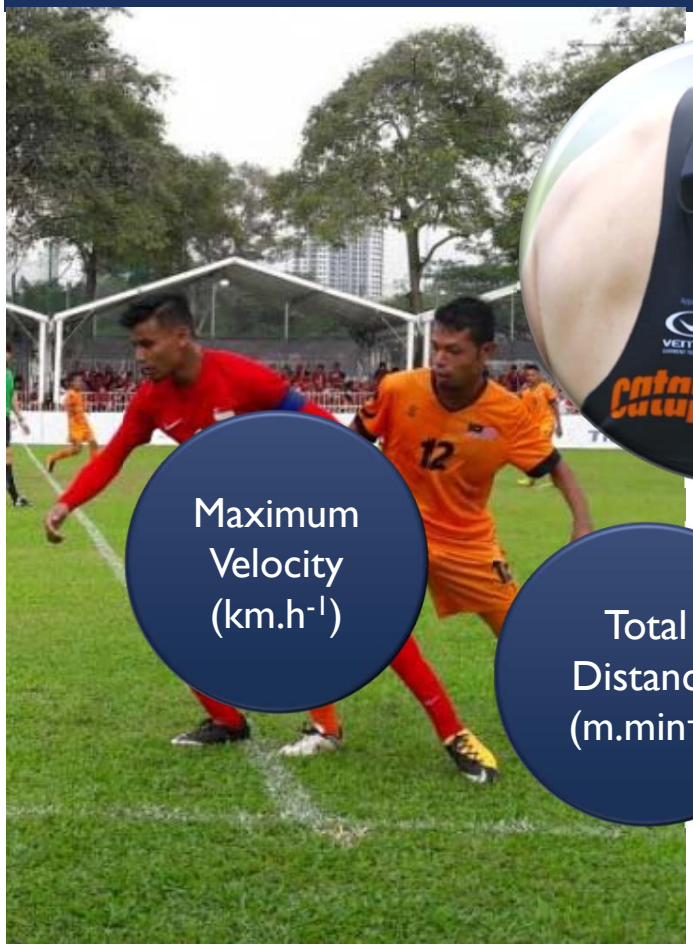
$\eta p2 > 0.54$, large; $p < 0.01$*

* Except Sprint 0-10 m

Reina, R., Sarabia, J.M., Caballero, C., & Yanci, J. (in Press)

- **What is Next?**

Game Analysis by GPS



Maximum Velocity ($km.h^{-1}$)

Total Distance ($m.min^{-1}$)

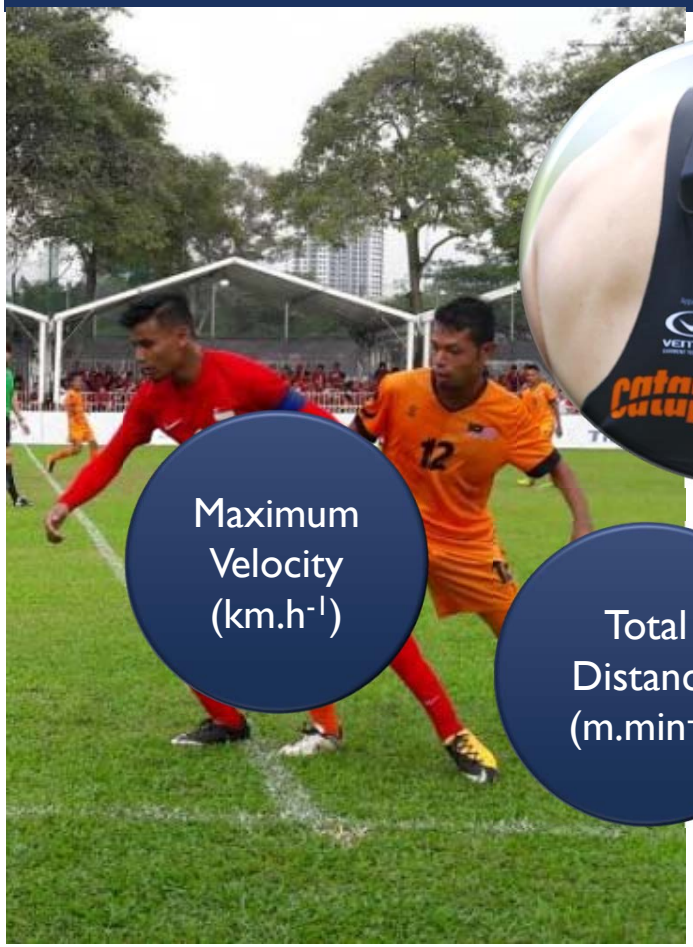
Acceler. / Deceler. ($n.min^{-1}$)

Change of Direction (number. min^{-1})

Distance covered ≠ Intensities ($m.min^{-1}$)

- Low Walking (< 4)
- Walking (4 - 3)
- Jogging (3 - 9)
- Medium Intensity Running (8 - 13)
- High Intensity Running (13 - 18)
- Sprinting (> 18)

Game Analysis by GPS



Maximum Velocity ($km.h^{-1}$)

Total Distance ($m.min^{-1}$)

Change of Direction (number. min^{-1})

Low Intensity

Medium Intensity

High Intensity

Distance covered ≠ Intensities ($m.min^{-1}$)

Mode- rate (1–2.78)

Acceler. / Deceler. ($n.min^{-1}$)

High (> 2.78)

Forward vs Back

Left vs Right

Journal of Strength and Conditioning Research Publish Ahead of Print
DOI: 10.1519/JSC.0000000000002085

Title of the Article

EVALUATION OF THE OFFICIAL MATCH EXTERNAL LOAD IN SOCCER PLAYERS WITH CEREBRAL PALSY

Yanci, J.[1], Castillo, D.[1], Iturricastillo, A.[1], Reina, R.[2]

Table 4 Low, medium and high changes of direction in forward, backward, left and right directions performed by football players with cerebral palsy (CP) during all observations and the three playing time groups (< 20 min, 20-40 min, > 40 min).

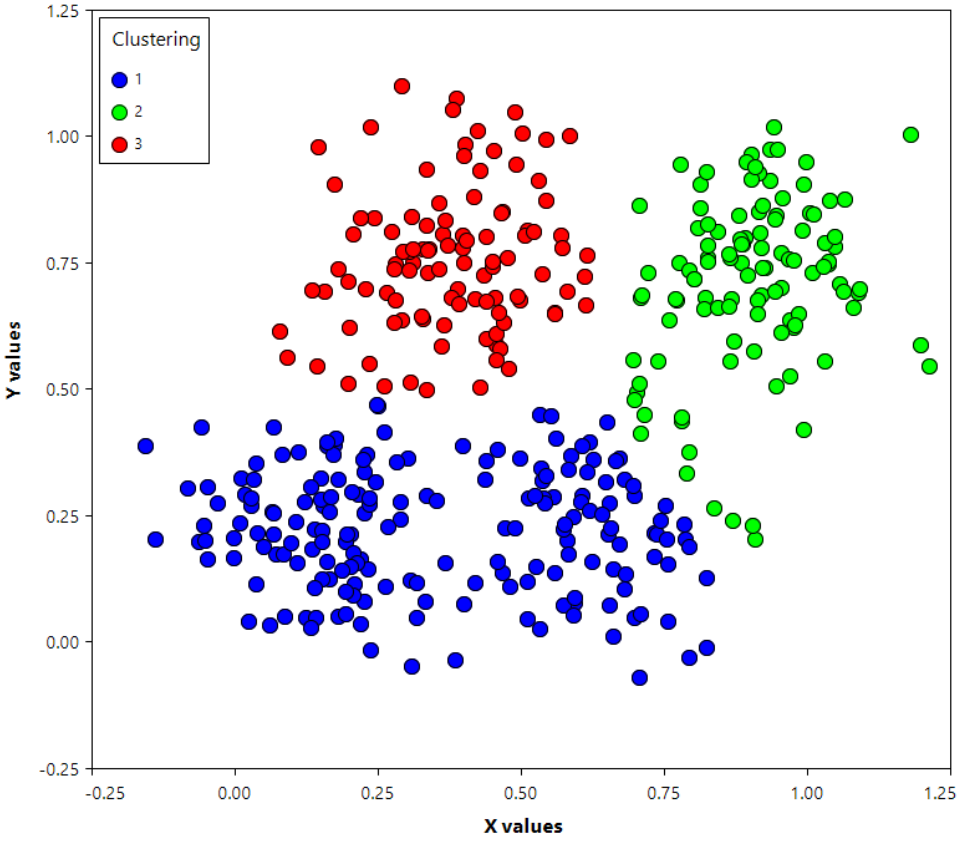
	All observations	Playing time < 20 min	Playing time 20-40 min	Playing time > 40 min	ES < 20 / 20-40 min	ES < 20 / > 40 min	ES 20-40 / > 40 min
Low intensity change of directions							
Forward	29.6 ± 24.2	6.7 ± 2.9	18.5 ± 11.0	38.6 ± 25.7	1.1	1.2**	0.8**
Backward	44.2 ± 26.1	10.9 ± 8.2	27.6 ± 17.0	57.6 ± 21.3	1.0	2.2**	1.4**
Left	121.7 ± 73.7	30.3 ± 20.6	81.9 ± 57.1	156.1 ± 62.5	0.9	2.0**	1.2**
Right	150.1 ± 89.2	43.4 ± 37.3	127.0 ± 104.8	180.5 ± 69.9	0.8	2.0**	0.8
Medium intensity change of directions							
Forward	8.4 ± 6.2	1.6 ± 2.1	6.1 ± 4.1	10.7 ± 6.2	1.1	1.5**	0.7*
Backward	16.4 ± 10.9	4.0 ± 3.8	9.7 ± 7.5	21.7 ± 9.4	0.8	1.9**	1.3**
Left	19.8 ± 14.2	4.1 ± 4.0	13.0 ± 5.7	25.6 ± 14.4	1.6	1.5**	0.9**
Right	23.6 ± 13.7	6.9 ± 5.8	16.0 ± 8.1	29.9 ± 12.4	1.1	1.9**	1.1**
High intensity change of directions							
Forward	4.1 ± 3.2	0.6 ± 0.8	2.5 ± 1.7	5.4 ± 3.1	1.1	1.6**	1.0**
Backward	6.9 ± 5.5	1.9 ± 2.3	3.8 ± 2.5	9.1 ± 5.7	0.8	1.3**	0.9**
Left	5.6 ± 5.8	1.4 ± 1.8	2.1 ± 2.5	7.9 ± 6.1	0.3	1.1**	0.9**
Right	6.3 ± 4.4	1.1 ± 1.8	4.7 ± 3.5	8.0 ± 4.1	1.0	1.6**	0.8*

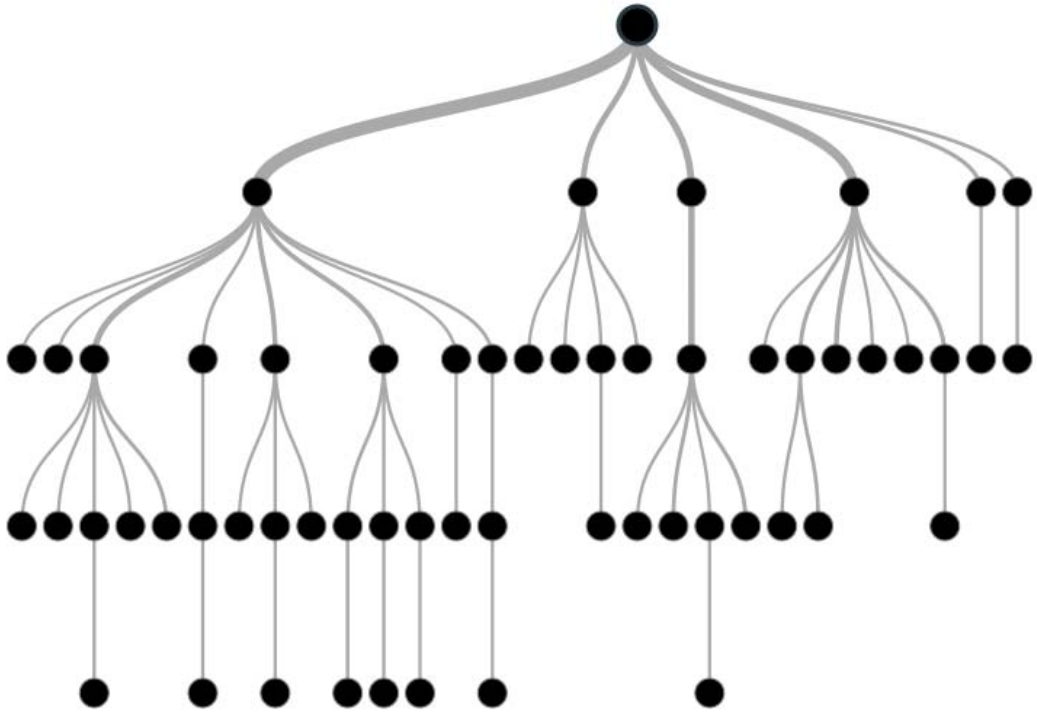
< 20 min = cerebral palsy football players who played 0-20 minutes; 20-40 min = cerebral palsy football players who played 20-40 minutes; > 40 min = cerebral palsy football players who played more than 40 minutes, ES = effect size. Significant difference (*p < 0.05, **p < 0.01)

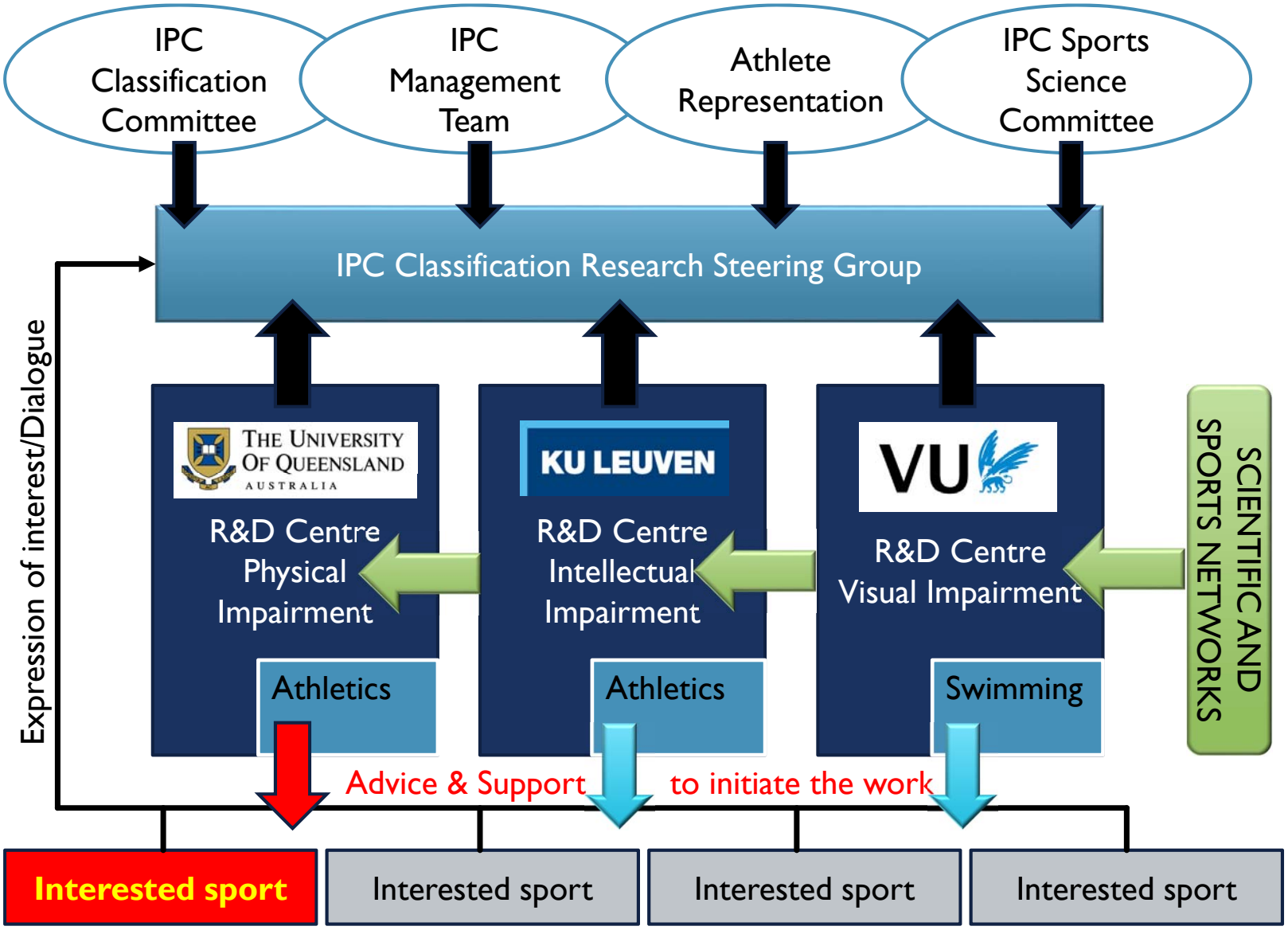
New Analysis may be Necessary…

	First half					Second half					Total
Team 1	**Left**	**Left 22**	Right	Right 22	Unknown	Left	Left 22	**Right**	**Right 22**	Unknown	
	18	57	116	59		36	81	52	15		
⊟ Attack	2	1	21	14		5	10	1			54
Break	1	1	3			1	1	1			8
Into 22			5	8		2	2				17
Offload	1		10				5				16
Pick and Go			3	3		1	1				8
Try				3		1	1				5
⊞ Defence	5	25	13	2		11	17	19	4		96
⊞ Error	2	11	8	3		1	3	3	2		33
⊞ Goal Kick			1	3		2	3				9
⊞ Lineout			9	3		2	1	3			18
⊞ Open Play Kick	3	5	4			1	6	7	3		29
⊞ Phase Play			5	11		3	3				22
⊞ Restart			3					1			4
⊞ RuckMaul	1	6	28	10		6	18	3	1		73
⊞ Scrum			4	5		2	5	2	2		20
⊞ Timings	5	9	20	8		3	15	13	3		76

New Statistics will be Necessary…







Van de Vliet (2015)