Sprint kayaking stroke rate reliability, variability and validity of the Digitrainer accelerometer compared to GoPro video measurement

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Determinants of performance

Average kayak velocity (m/s)

r = 0.19; p>0.05

(Hay & Yanai, 1996)

r = 0.86; p<0.001

(Mononen & Viitasalo, 1995)

r = 0.75; p<0.05

(Hay & Yanai, 1996)

Kayak displacement (m)

Stroke rate (spm)

Determinants of performance

Stroke rate (spm)

(Janssen & Sachlikidis, 2010)

Reliability, variability and validity?

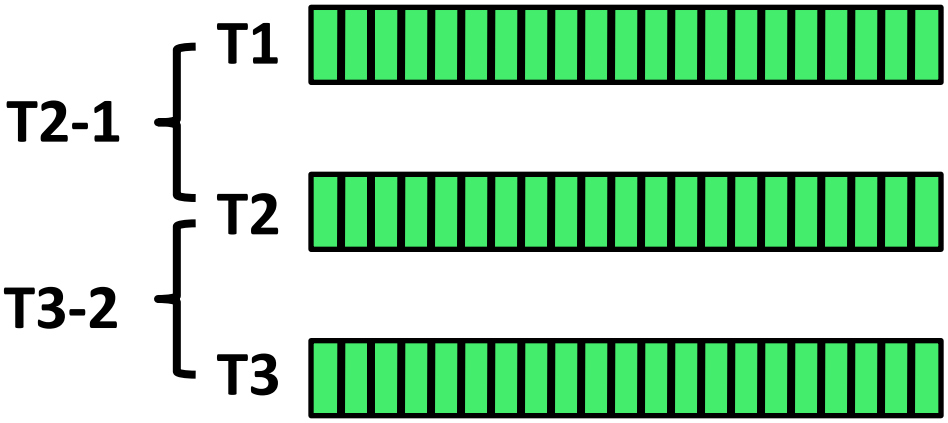
Aim

Stroke rate (spm)

Within-trial reliability

Stroke sample = 40

Between-trial reliability/variability



Validity


DigiTrainer
HERO
GoPro
Vajda
Paddlers = 3 male; 3 female
Speed (m/s)
Selection avg: 4.3
5
3
2
1
0
Start
3 x 300-m
Training 05:52
06:30
07:00
07:30
08:00
08:16



Raw data

Stroke-to-stroke

Paddler	Stroke	T1	T1	T2	T2-1
P1	1	97			
	2	97			
	3	97			
	4	97			
	5	100			
	6	95			
	7	100			
	Mean				
	SD				
	CV%				
⋮		⋮			
Pn	1				



Raw data

Paddler	Stroke	Stroke-to-stroke T1	Five-point moving average T1	T2	T2-1
P1	1	97	$X_{T1(S1-S5)}$		
	2	97	$X_{T1(S2-S6)}$		
	3	97	$X_{T1(S3-S7)}$		
	4	97			
	5	100			
	6	95			
	7	100			
	Mean				
	SD				
	CV%				
⋮		⋮			
Pn	1				



Raw data

Stroke-to-stroke

Five-point moving average

Paddler	Stroke	T1	T1	T2	T2-1
P1	1	97	$X_{T1(S1-S5)}$		
	2	97	$X_{T1(S2-S6)}$		
	3	97	$X_{T1(S3-S7)}$		
	4	97			
	5	100			
	6	95			
	7	100			
	Mean		$5Mean_{T1}$		
	SD	A	$5SD_{T1}$		
	CV%		$5CV_{T1}$		
⋮		⋮	⋮		
Pn	1		$5Mean_{T1}$		
			$5SD_{T1}$		
			$5CV_{T1}$		



Raw data

Stroke-to-stroke			Five-point moving average		
Paddler	Stroke	T1	T1	T2	T2-1
P1	1	97	$X_{T1(S1-S5)}$	$X_{T2(S1-S5)}$	
	2	97	$X_{T1(S2-S6)}$	$X_{T2(S2-S6)}$	
	3	97	$X_{T1(S3-S7)}$	$X_{T2(S3-S7)}$	
	4	97			
	5	100			
	6	95			
	7	100			
	Mean		$5Mean_{T1}$	$5Mean_{T2}$	
	SD	A	$5SD_{T1}$	$5SD_{T2}$	
	CV%		$5CV_{T1}$	$5CV_{T2}$	
⋮		⋮	⋮	⋮	
Pn	1		$5Mean_{T1}$	$5Mean_{T2}$	
			$5SD_{T1}$	$5SD_{T2}$	
			$5CV_{T1}$	$5CV_{T2}$	



Raw data

Log-transformed

Stroke-to-stroke

Five-point moving average

Paddler	Stroke	T1	T1	T2	T2-1
P1	1	97	$X_{T1(S1-S5)}$	$X_{T2(S1-S5)}$	Δ
	2	97	$X_{T1(S2-S6)}$	$X_{T2(S2-S6)}$	Δ
	3	97	$X_{T1(S3-S7)}$	$X_{T2(S3-S7)}$	Δ
	4	97			
	5	100			
	6	95			
	7	100			
	Mean		$5Mean_{T1}$	$5Mean_{T2}$	5Mdiff%
	SD		$5SD_{T1}$	$5SD_{T2}$	
	CV%		$5CV_{T1}$	$5CV_{T2}$	
⋮		⋮	⋮	⋮	⋮
Pn	1		$5Mean_{T1}$	$5Mean_{T2}$	5Mdiff%
			$5SD_{T1}$	$5SD_{T2}$	
			$5CV_{T1}$	$5CV_{T2}$	

A

B

Interpreting reliability and variability

Stroke rate within-trial reliability

R good reliability = CV% ≤2.8%

R poor reliability = CV% >2.8%

Stroke rate between-trial reliability and variability

R Good reliability = Mdiff% ≤5% and ES ≤0.6

R Moderate reliability = Mdiff% >5% or ES >0.6

R Poor reliability = Mdiff% >5% and ES >0.6

V Small variability = ICCr >0.67 and TE% ≤10%

V Moderate variability = ICCr <0.67 or TE% >10%

V Large variability = ICCr <0.67 and TE% >10%

(Bradshaw, Hume, Calton, & Aisbett, 2010)

Within-trial

Between-trial

2.6% CV

2.2% CV

2.2% CV

1.8% CV

2.4% CV

2.0% CV

T1

T2

T3

T2-1

T3-2

R V

R V

R V

R V

(n = 36)

Validity

Pearson correlation coefficient

$r = 0.86, p = 0.000$

Strong, significant correlation between Digitrainer and video stroke rates (spm)

Digitrainer stroke rate overestimation (4 ±5 spm)*

*Results limited to one device.

Stroke rate (spm)

Mean ±SD

T1	108 ±2.8	103 ±2.3
T2	106 ±2.3	101 ±1.8
T3	106 ±2.6	102 ±2.1

Conclusion

R V

Consistent

Accurate

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AUT

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