

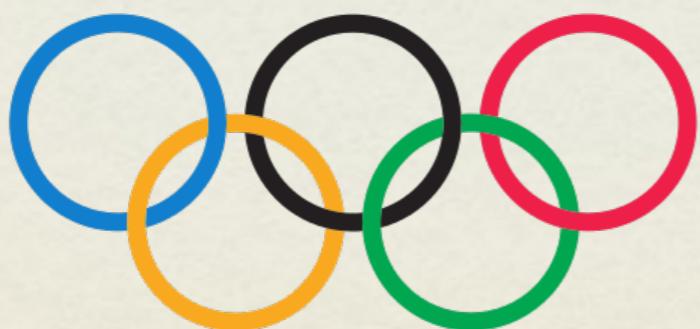


ELITE ATHLETICS: IS THE FALSE START DISQUALIFICATION RULE APPROPRIATE?

Kevin Brosnan

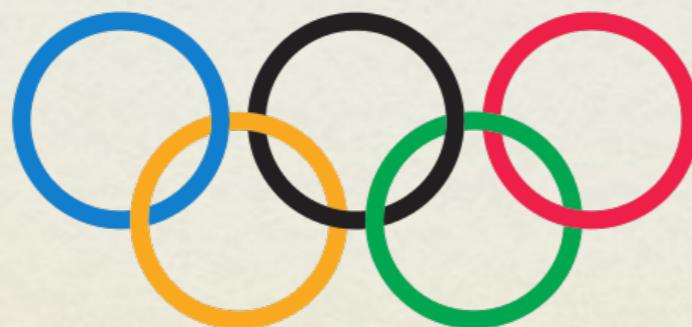


Rio 2016TM





Rio 2016™



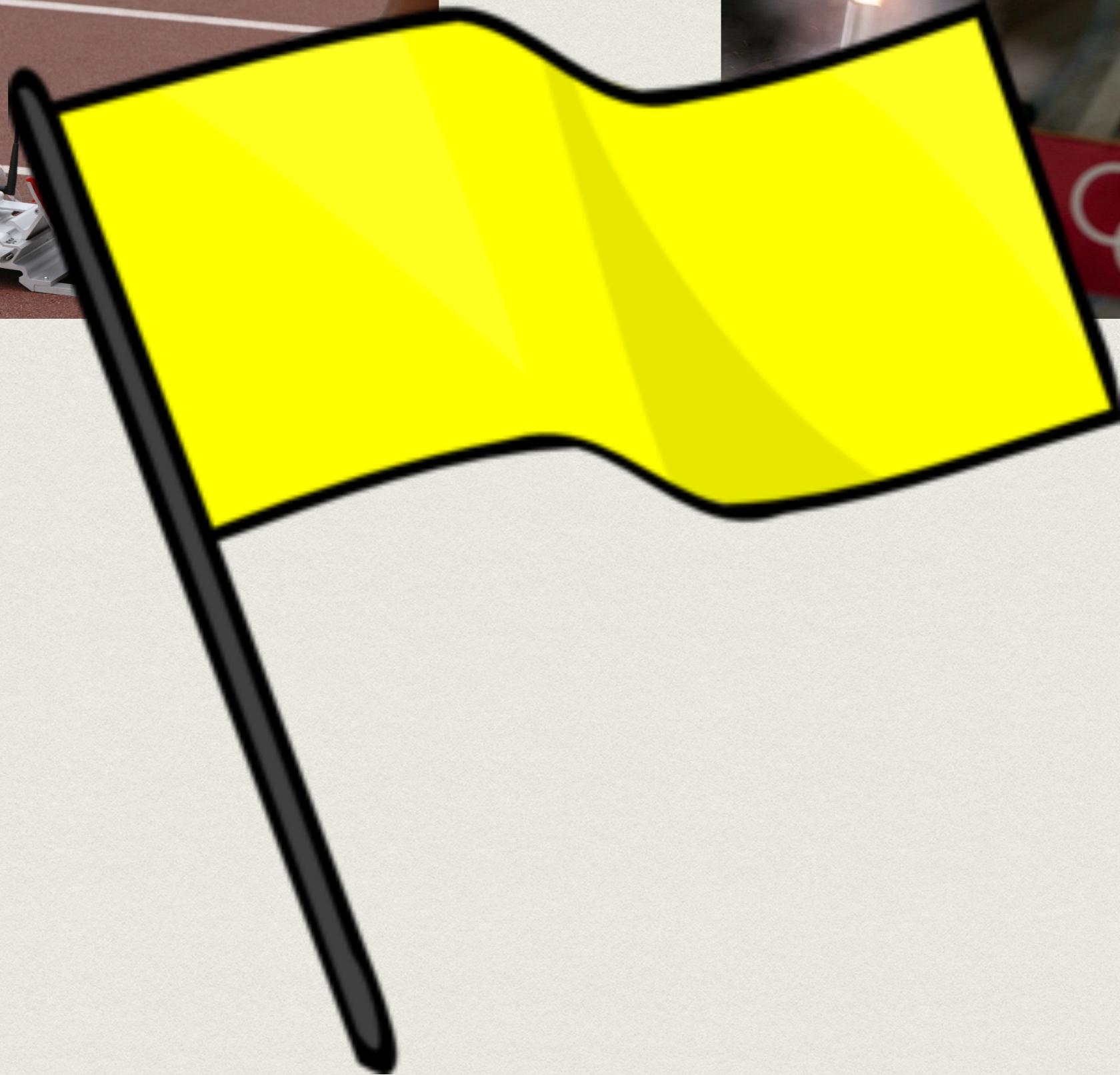


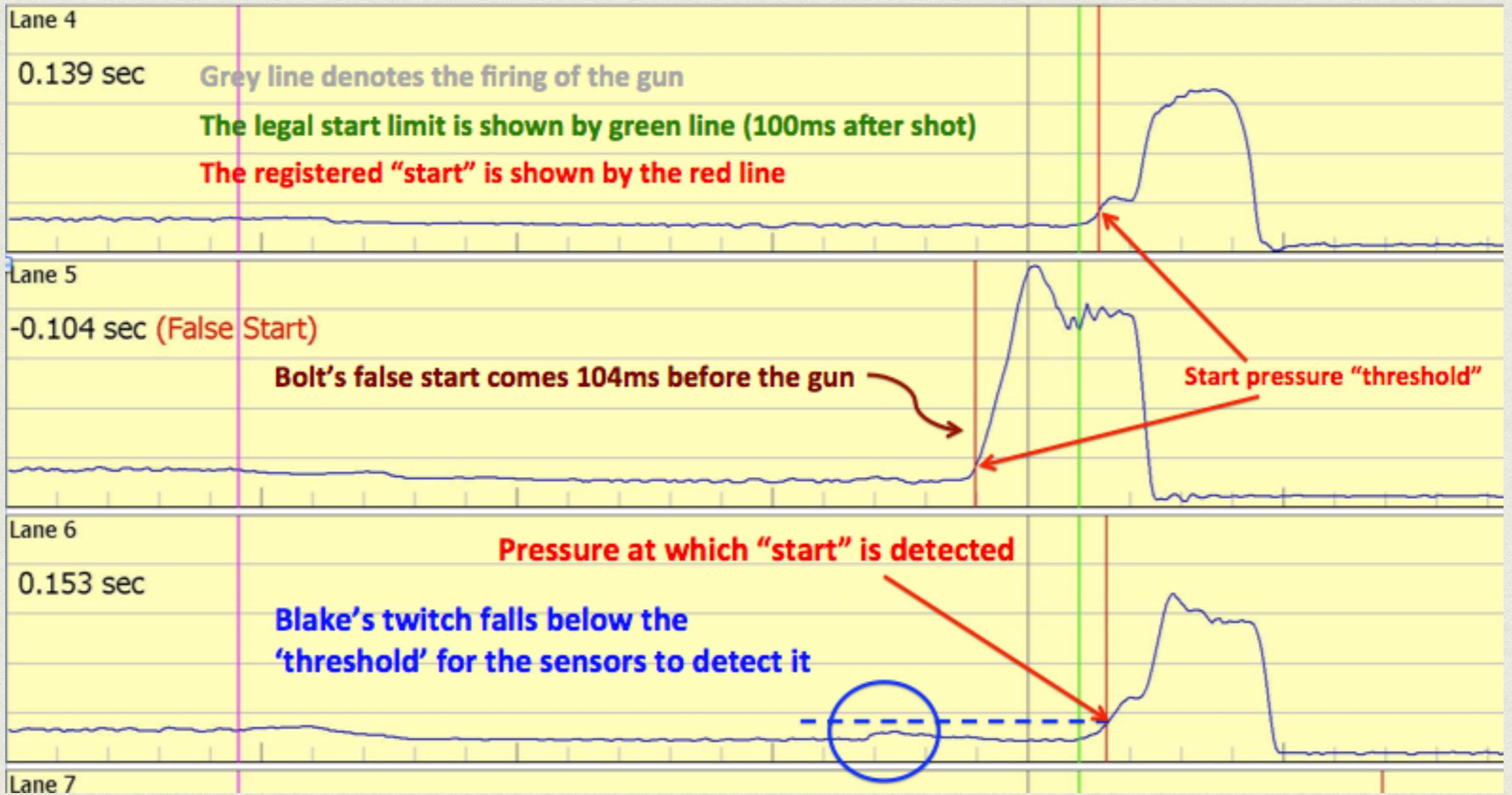
Rio 2016™











1

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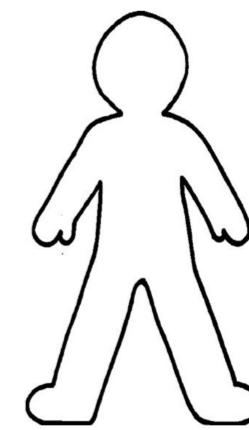
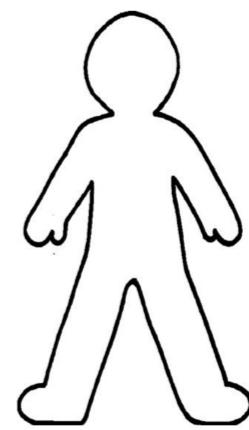
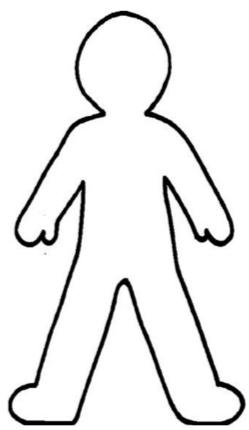
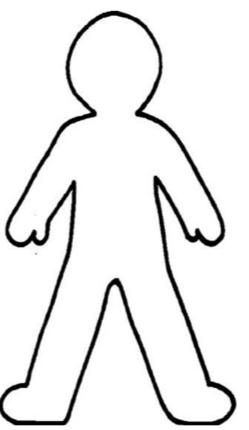
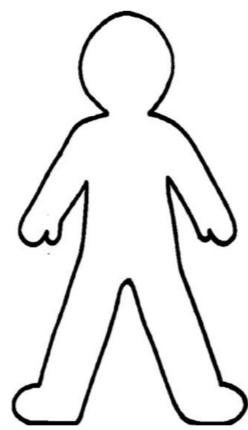
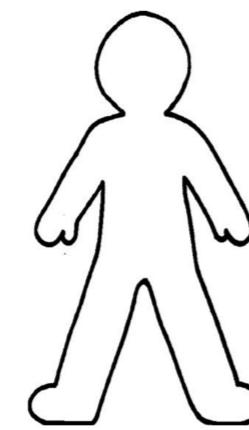
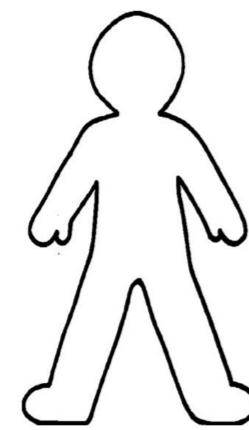
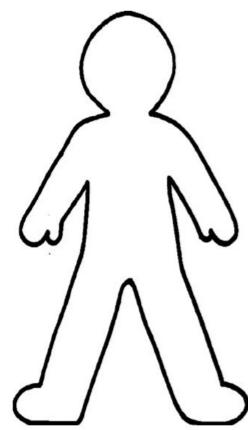
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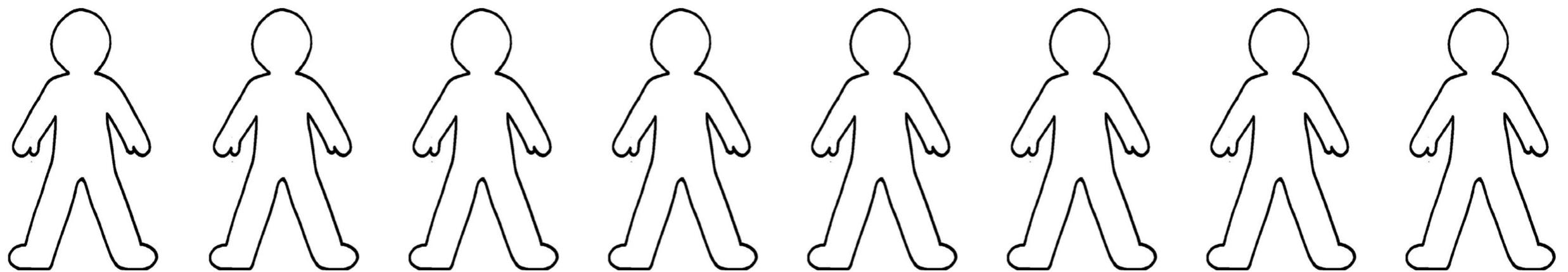
1998

2004

2010

2016

1 2 3 4 5 6 7 8

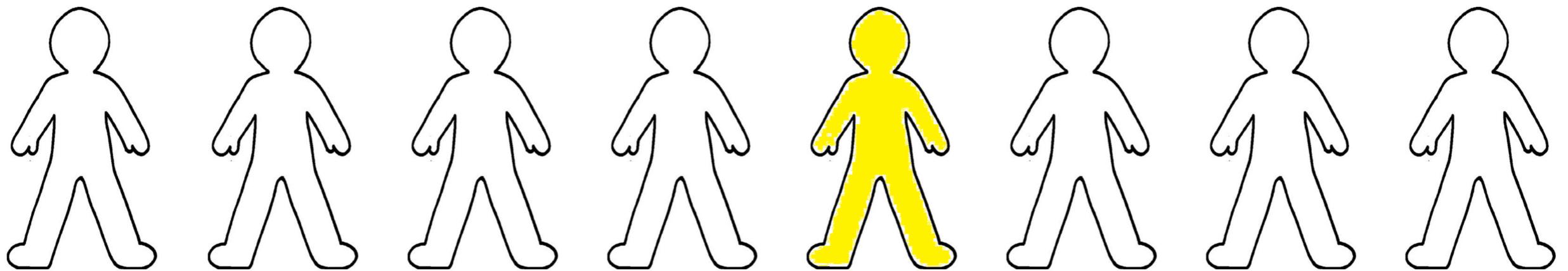


1998 ————— 2004 ————— 2010 ————— 2016

Individual Warning

False Start 1: Lane 5

1 2 3 4 5 6 7 8



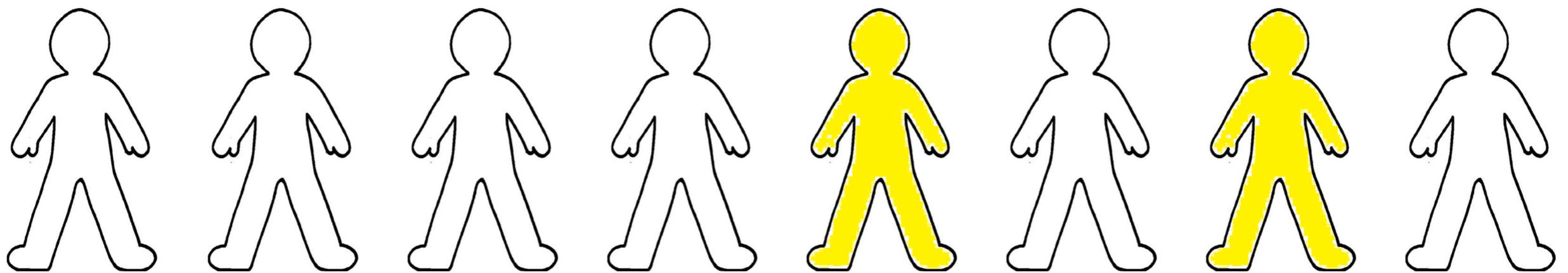
1998 ————— 2004 ————— 2010 ————— 2016

Individual Warning

False Start 1: Lane 5

False Start 2: Lane 7

1 2 3 4 5 6 7 8



1998 ————— 2004 ————— 2010 ————— 2016

Individual Warning

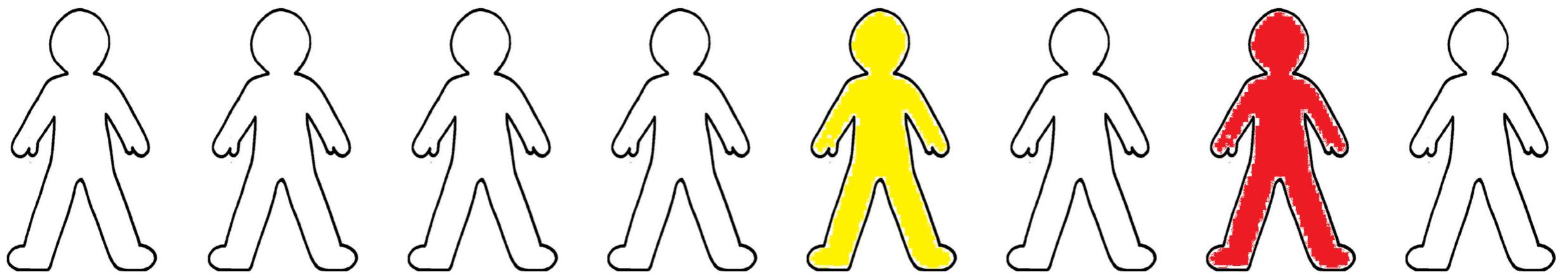
False Start 1: Lane 5

False Start 2: Lane 7

False Start 3: Lane 7

Lane 7 Athlete Disqualified

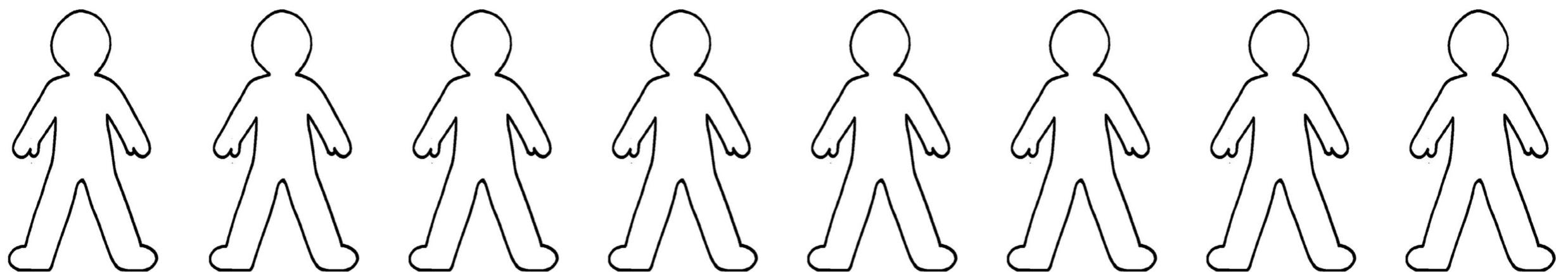
1 2 3 4 5 6 7 8



1998 ————— 2004 ————— 2010 ————— 2016

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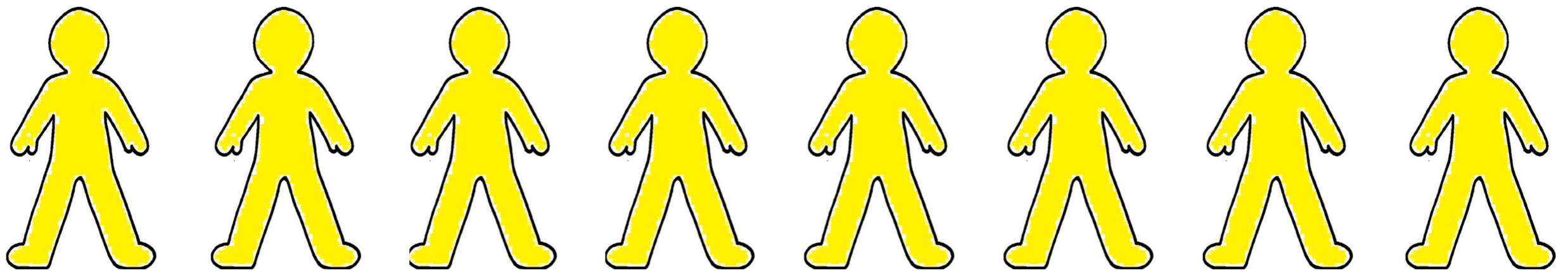


1998 ————— 2004 ————— 2010 ————— 2016

Group Warning

False Start 1: Lane 5

1 2 3 4 5 6 7 8



1998 ————— 2004 ————— 2010 ————— 2016

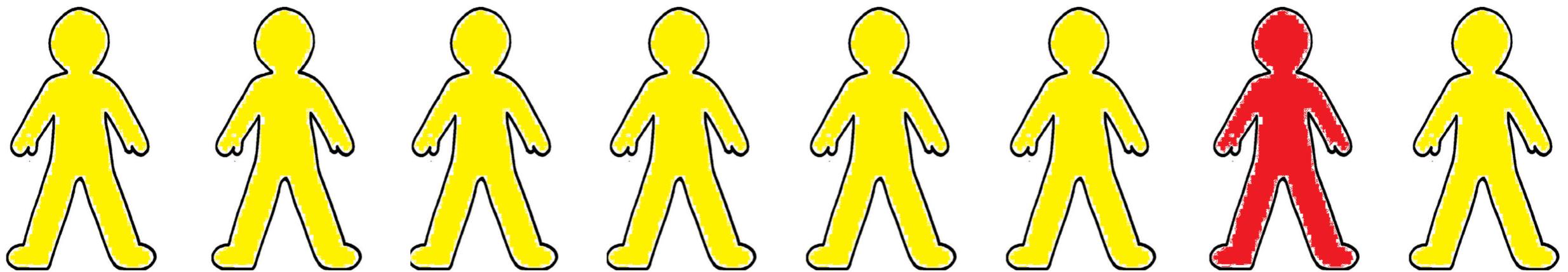
Group Warning

False Start 1: Lane 5

False Start 2: Lane 7

Lane 7 Athlete Disqualified

1 2 3 4 5 6 7 8



1998

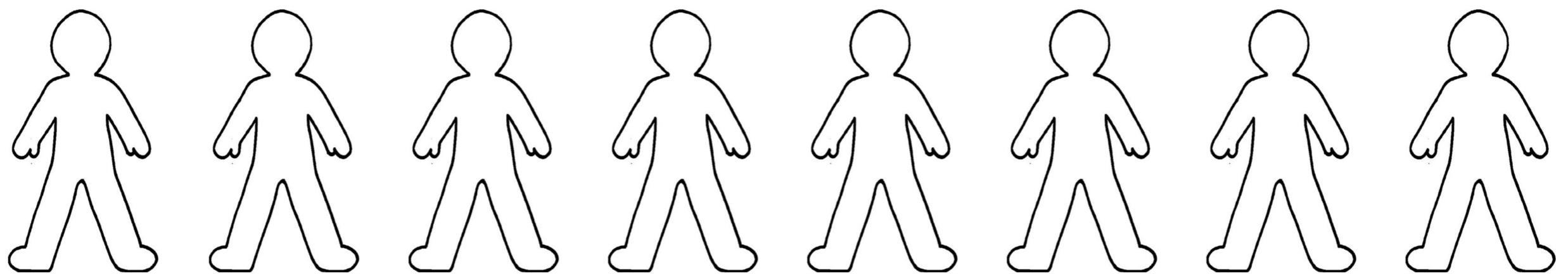
2004

2010

2016

Group Warning

1 2 3 4 5 6 7 8



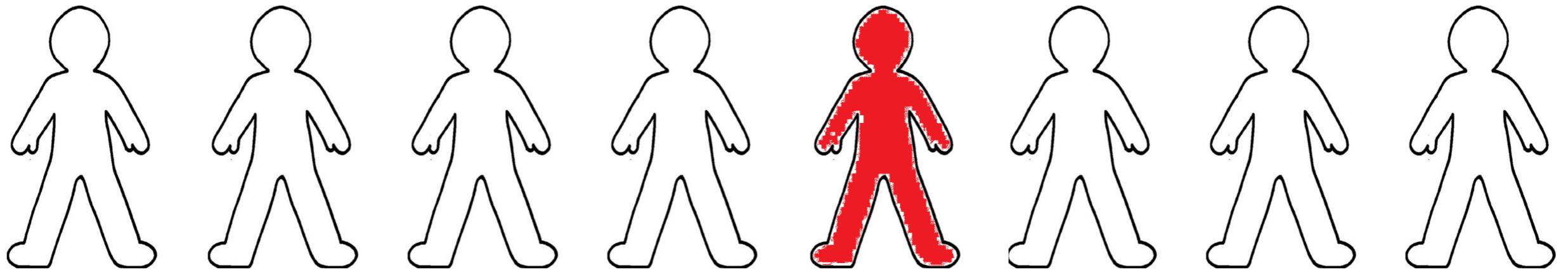
1998 ————— 2004 ————— 2010 ————— 2016

Automatic DQ

False Start 1: Lane 5

Lane 5 Athlete Disqualified

1 2 3 4 5 6 7 8



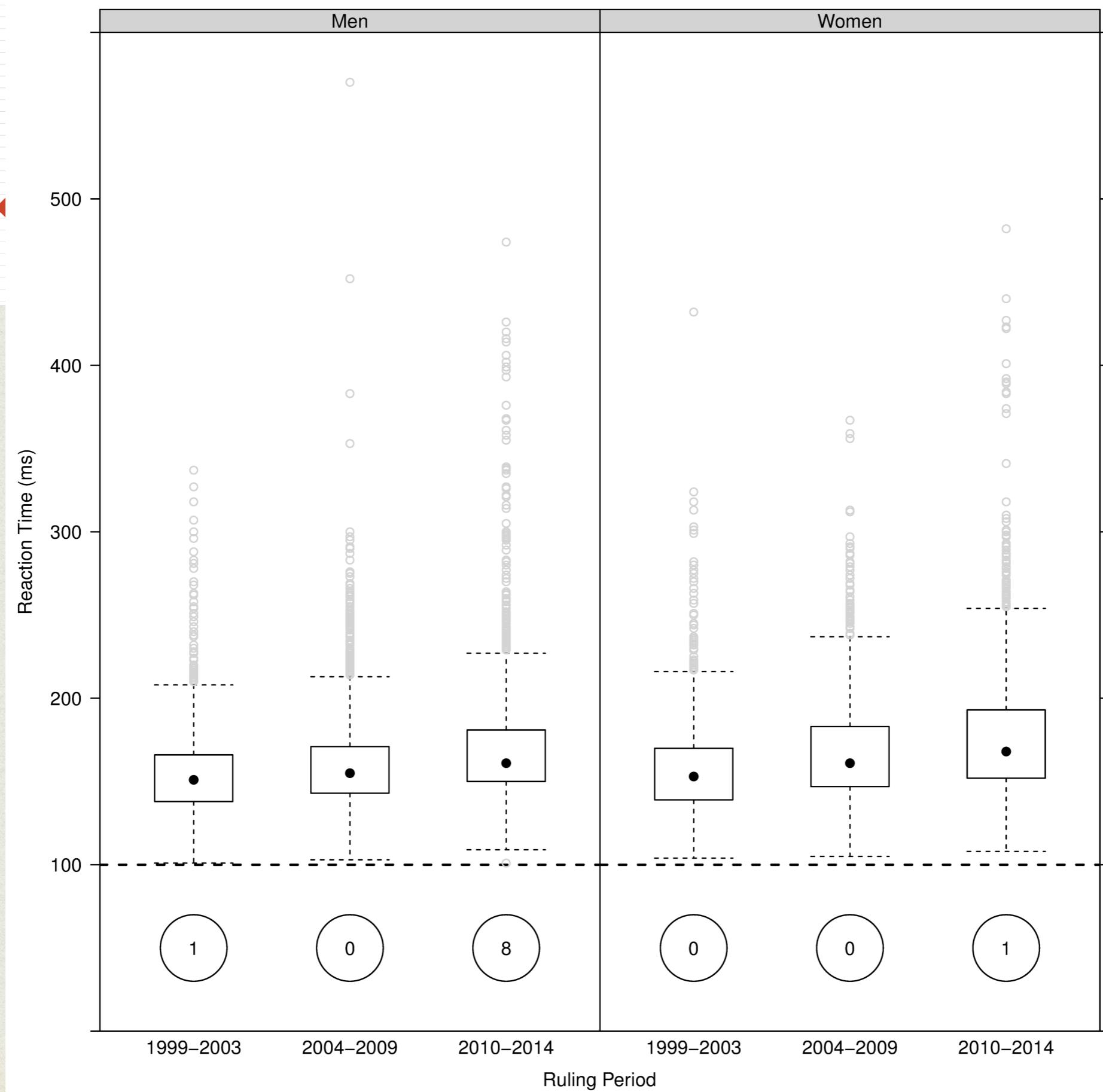
1998 ————— 2004 ————— 2010 ————— 2016

Automatic DQ

Competition	Sex	Event	Year	Venue	Round	Heat	Wind	Sprinter	FinishTime	ReactionTime	Result	RuleChange
Worlds	Mens	60m	2014	Sopot	1	1	NA	Gerald PHIRI	6.59	0.148	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Kimmari ROACH	6.59	0.17	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Marvin BRACY	6.6	0.216	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Fabio CERUTTI	6.67	0.127	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Tom KLING-BAPTISTE	6.72	0.164	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Sibusiso MATSENJWA	6.88	0.206	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Jean Thierle FERDINAND	6.98	0.158	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Bingtian SU	6.58	0.185	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Yoshihide KIRYU	6.65	0.164	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Trell KIMMONS	6.68	0.15	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Hassan TAFTIAN	6.69	0.185	FastestQualifier	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Adam ZAVACKY	6.71	0.153	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Odain ROSE	6.71	0.146	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Cristian LEGUIZAMON	7.02	0.216	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	3	NA	Jason ROGERS	6.59	0.135	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	3	NA	Warren FRASER	6.61	0.13	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	3	NA	Pel meng ZHANG	6.65	0.153	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	3	NA	Remigiusz OLSZEWSKI	6.69	0.166	FastestQualifier	2010-2014
Worlds	Mens	60m	2014	Sopot	1	3	NA	T.J. LAWRENCE	6.74	0.151	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	3	NA	Gregory BRADAI	7.3	0.187	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	3	NA	Yonder NAMELO	7.56	0.203	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	3	NA	Solomon BOCKARIE	NA	NA	DNS	2010-2014
Worlds	Mens	60m	2014	Sopot	1	4	NA	Richard KILTY	6.53	0.122	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	4	NA	Reza GHASEMI	6.58	0.156	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	4	NA	Nesta CARTER	6.58	0.172	Qualified	2010-2014

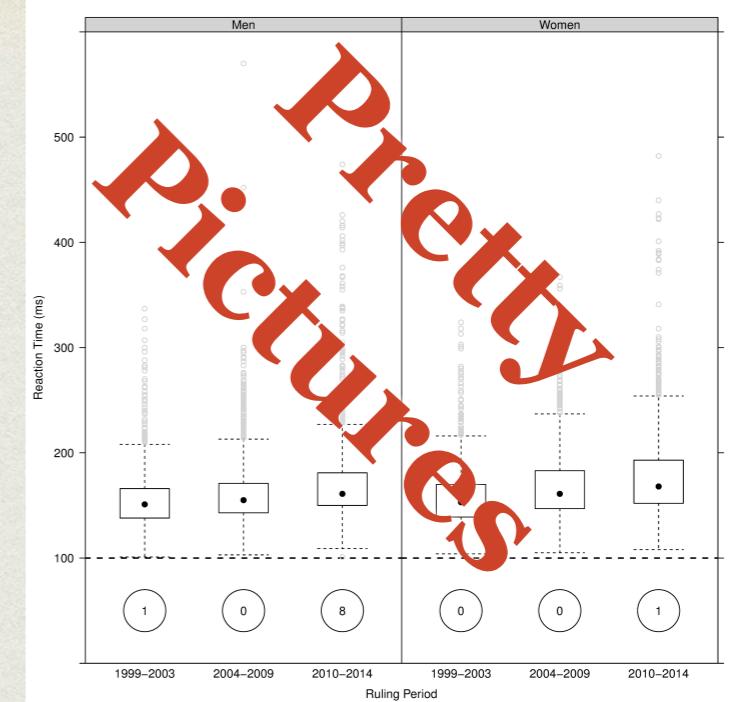
Competition	Sex	Event	Year	Venue	Round	Heat	Wind	Sprinter	FinishTime	ReactionTime	Result	RuleChange
Worlds	Mens	60m	2014	Sopot	1	1	NA	Gerald PHIRI	6.59	0.148	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Kimmarie ROACH	6.59	0.17	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Marvin BRACY	6.6	0.216	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Fabio CERUTTI	6.67	0.127	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Tom KLING-BAPTISTE	6.72	0.164	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Sibusiso MATSENWA	6.88	0.206	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Jean Thierle FERDINAND	6.98	0.158	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Bingtan SU	6.98	0.185	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Yoshinori KIRYU	6.65	0.164	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Troy COOPER	6.68	0.15	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Hughie TAFT	6.69	0.185	FastestQualifier	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Adam ZAVACKY	6.71	0.153	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Colin ROSE	6.71	0.146	Eliminated	2010-2014
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DATA



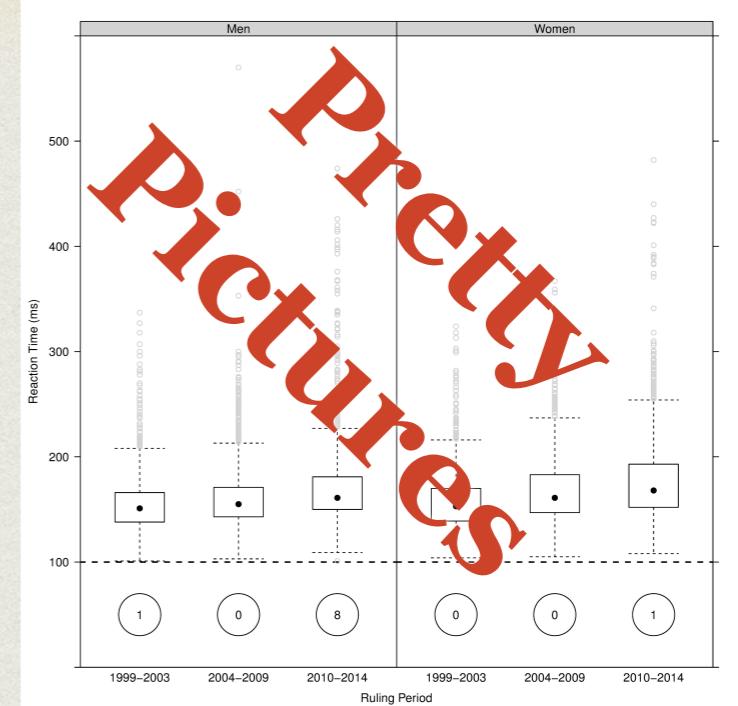
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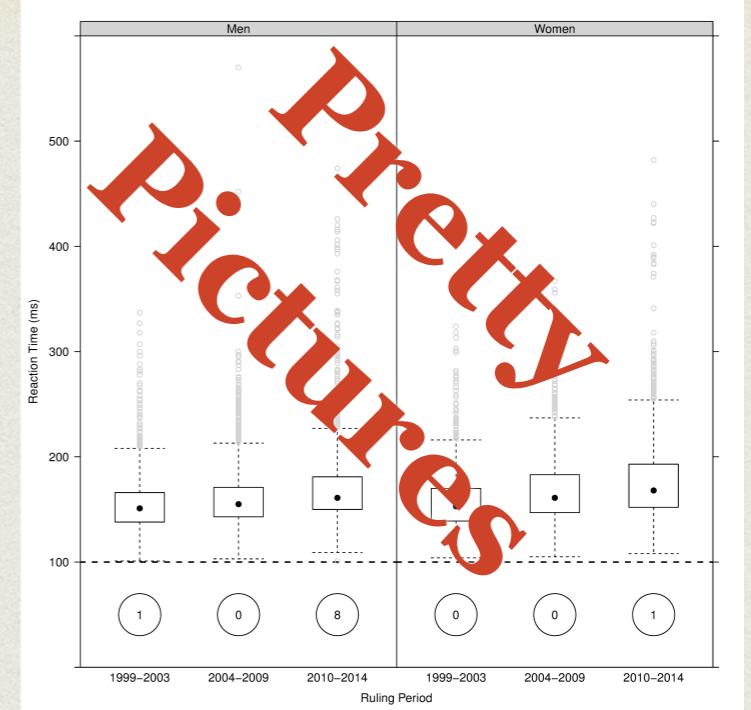
DATA



$$f(RT|\mu, \sigma, \tau) = \frac{1}{\tau} \exp \left\{ \frac{\mu}{\tau} + \frac{\sigma^2}{2\tau^2} - \frac{RT}{\tau} \right\} \Phi \left(\frac{RT - \mu - \frac{\sigma^2}{\tau}}{\sigma} \right)$$

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Worlds	Mens	60m	2014	Sopot	1	4	NA	Richard KILTY	6.53	0.122	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	4	NA	Reza GHASEMI	6.58	0.156	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	4	NA	Nesta CARTER	6.58	0.172	Qualified	2010-2014

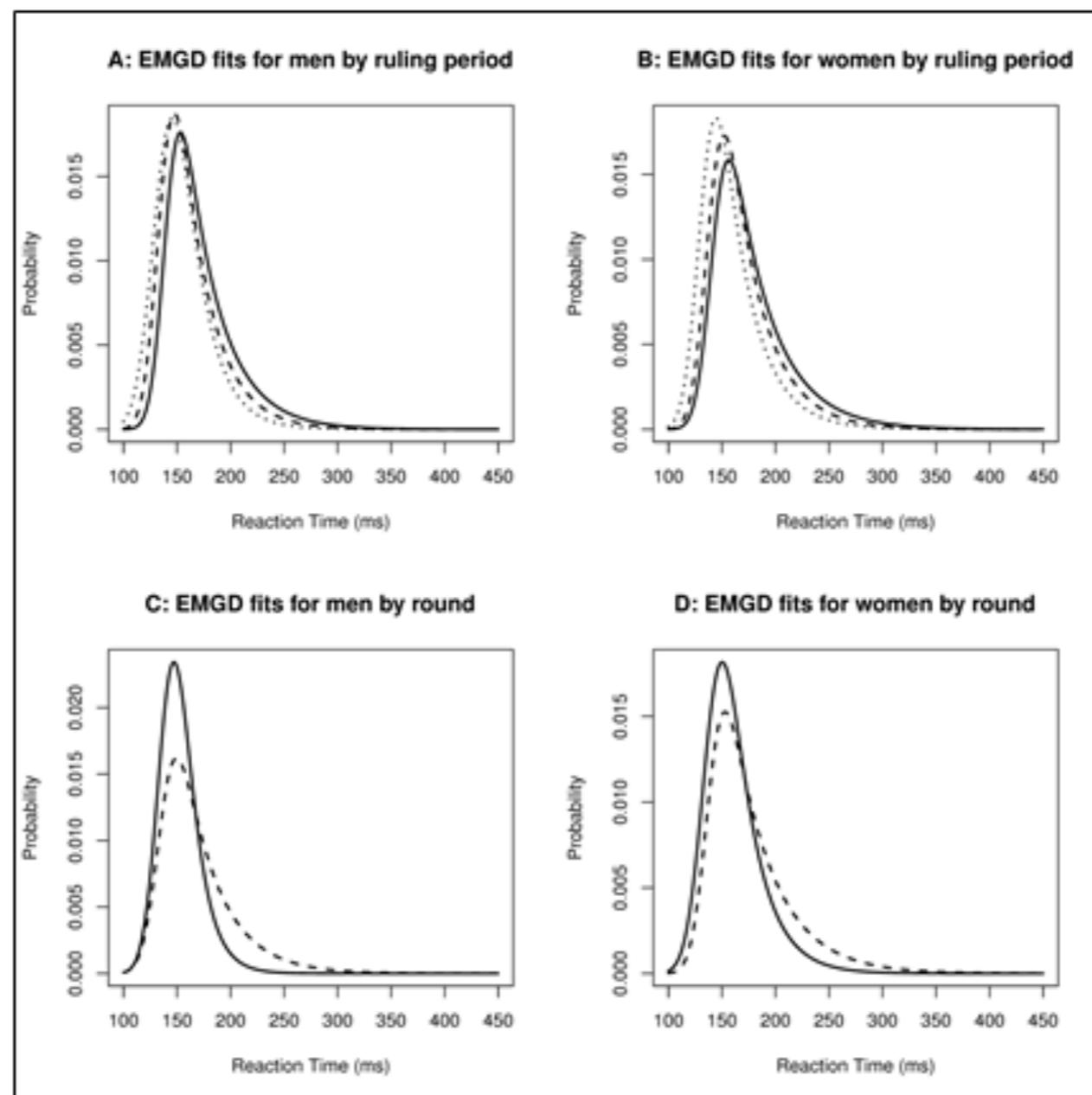
DATA



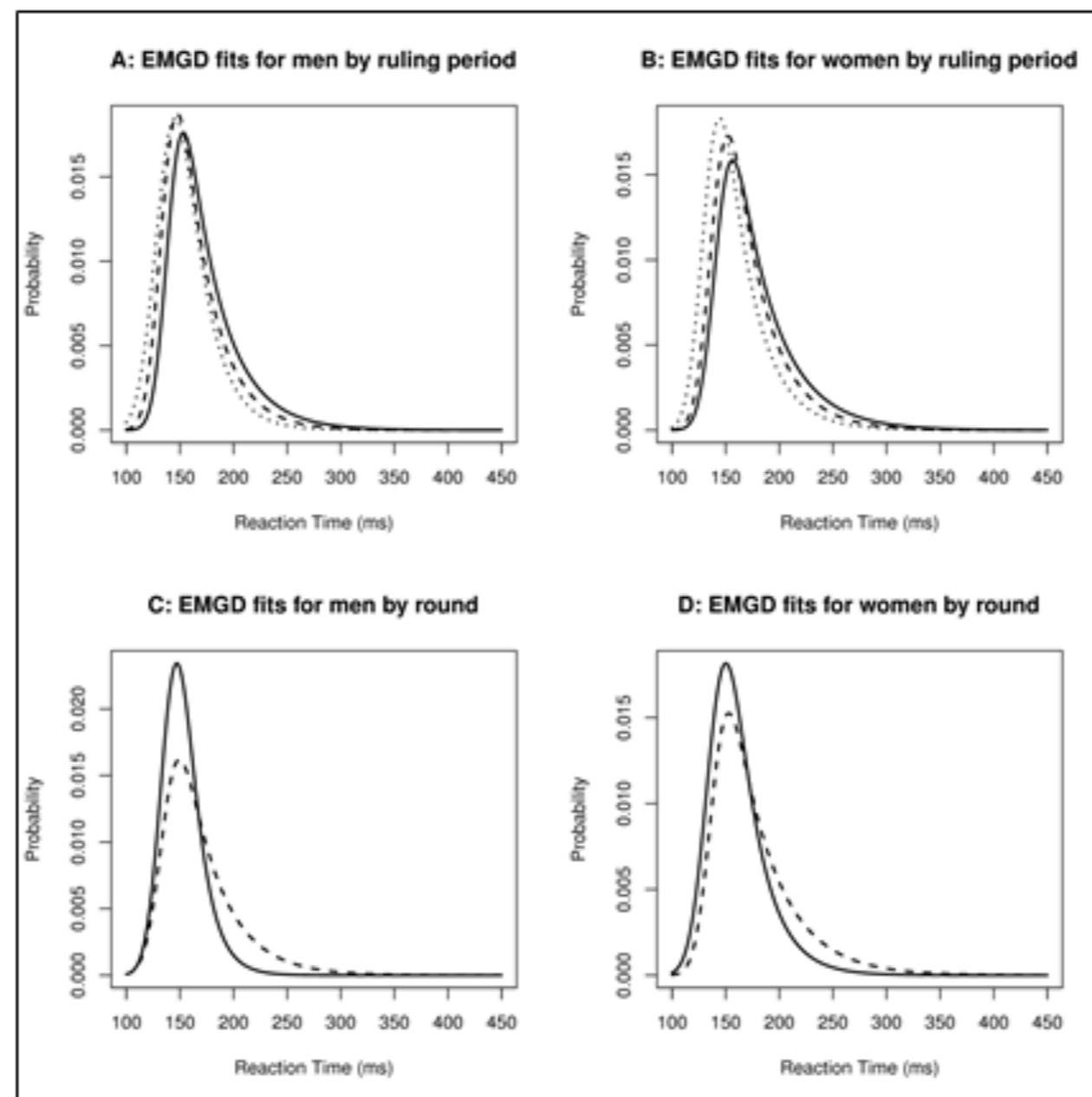
Modelling

$$f(RT|\mu, \sigma, \tau) = \frac{1}{\tau} \exp\left(\frac{\mu}{\sigma^2} - \frac{RT}{\tau}\right) \Phi\left(\frac{RT - \mu - \frac{\sigma^2}{\tau}}{\sigma}\right)$$

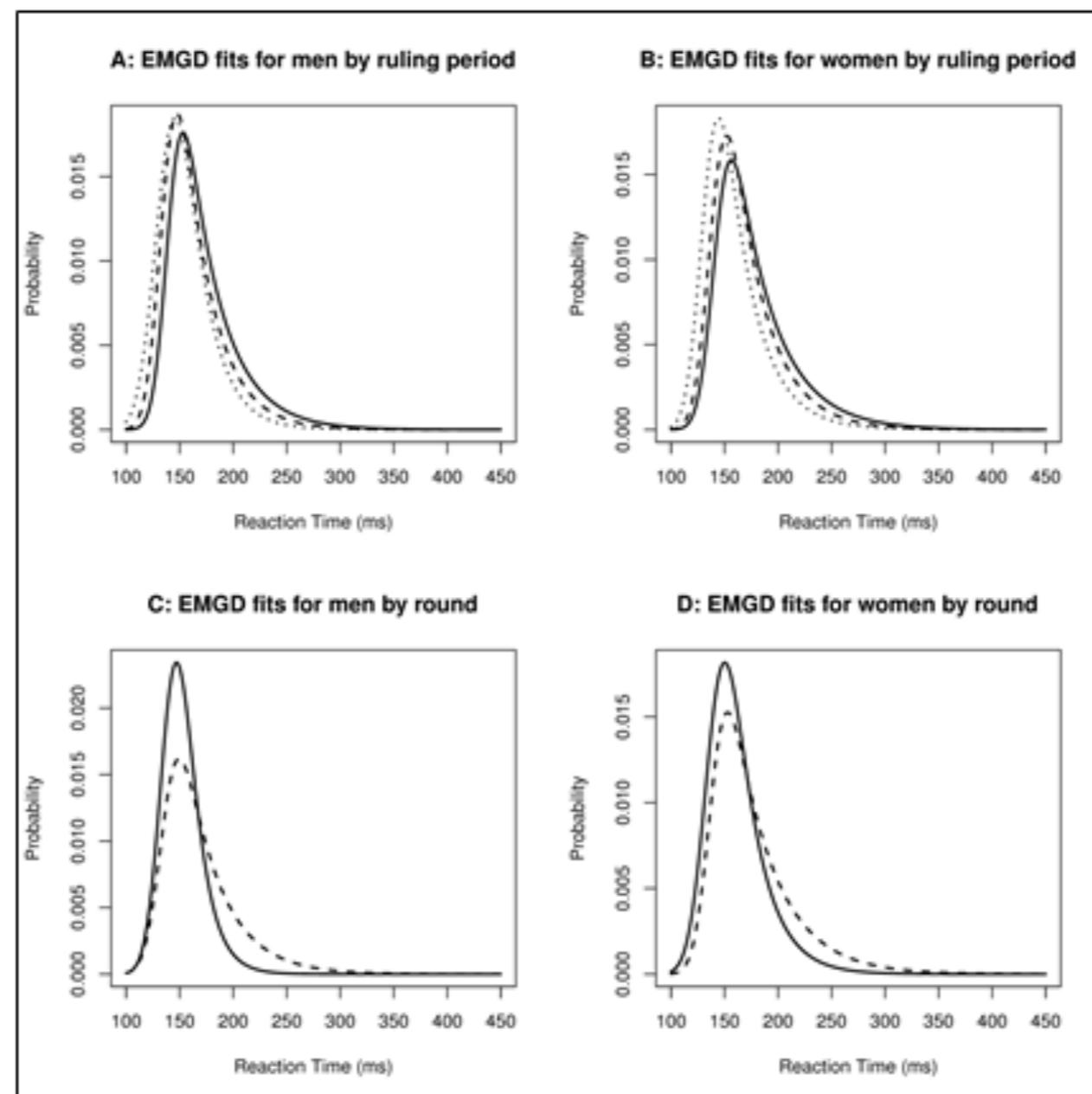
Recommendations



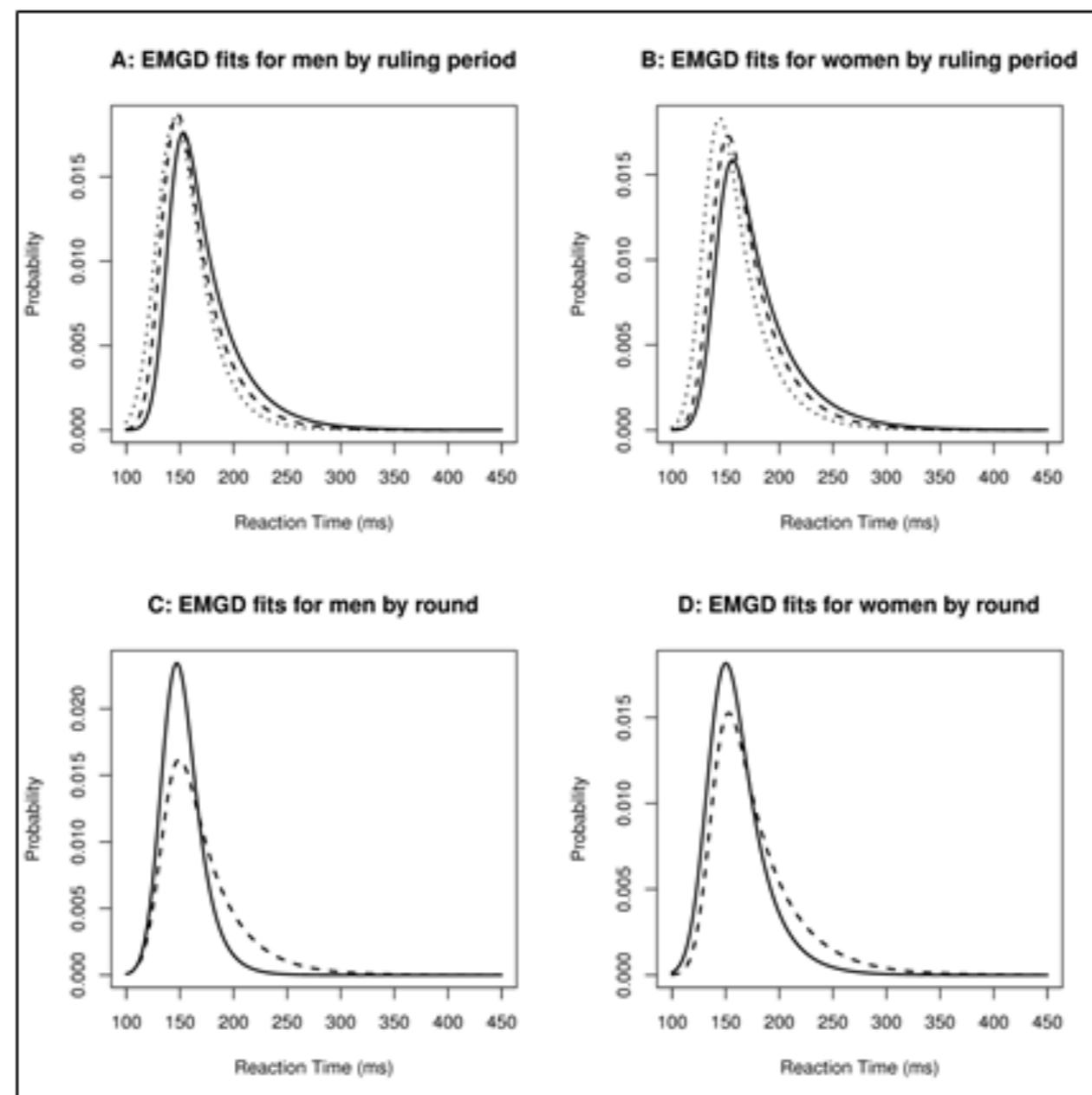
Recommendations



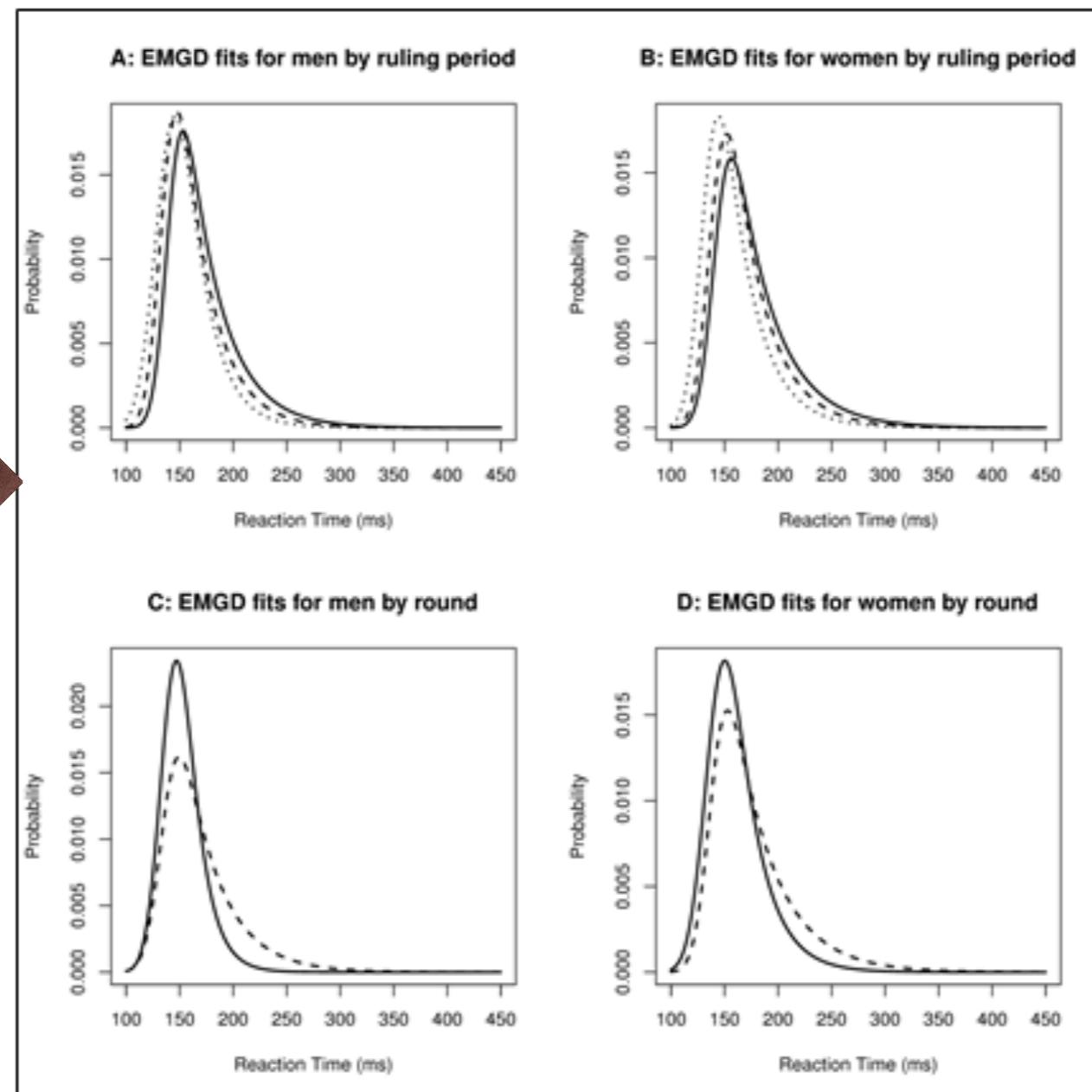
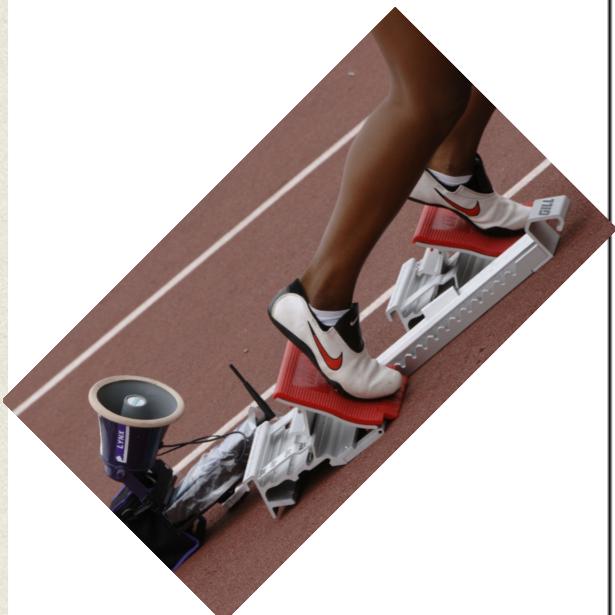
Recommendations



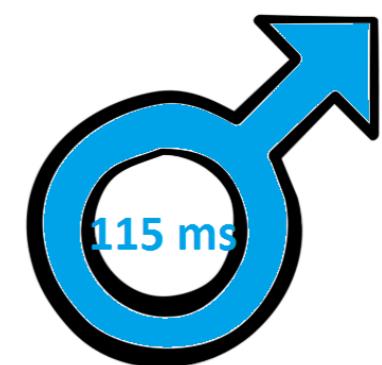
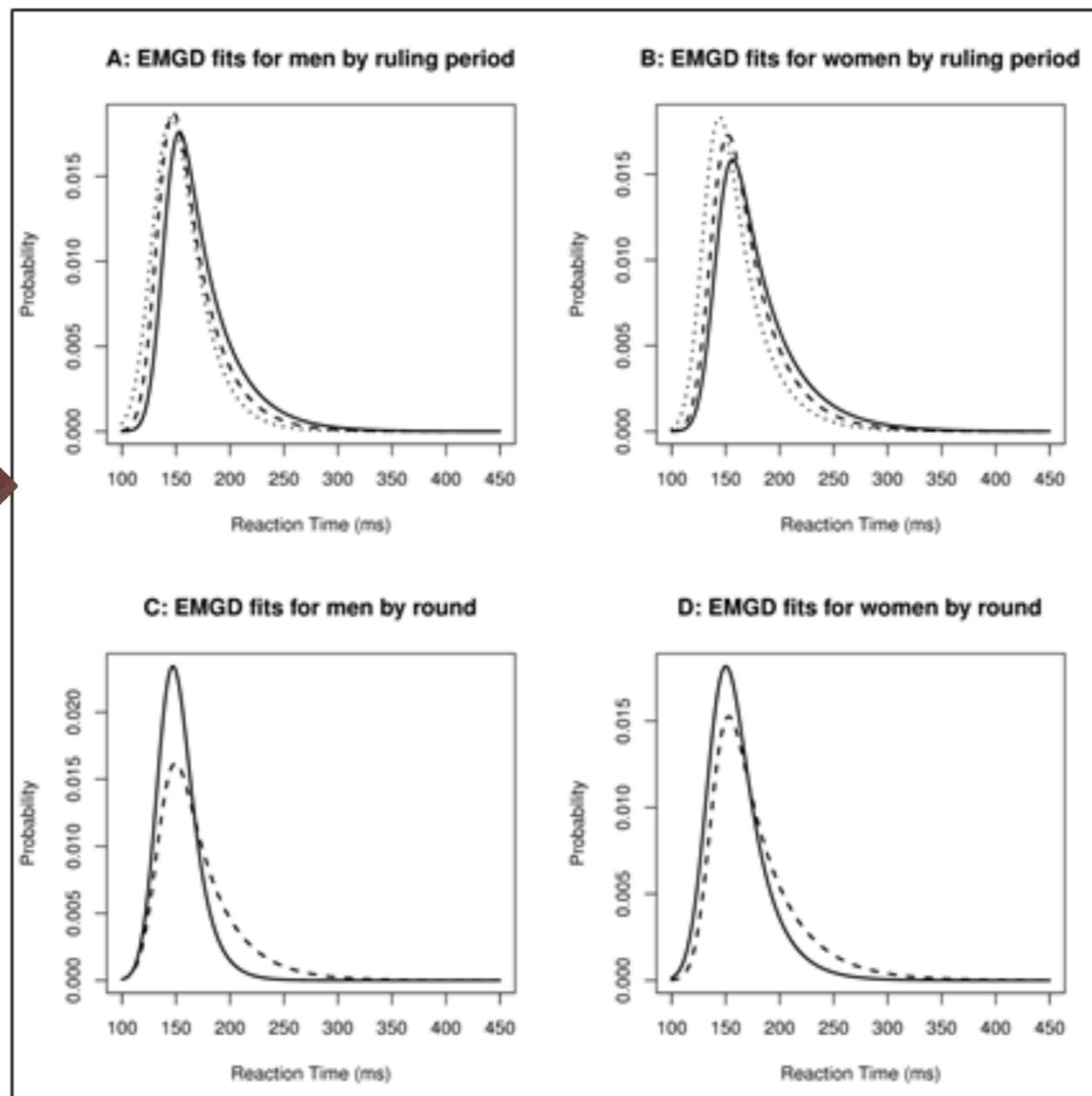
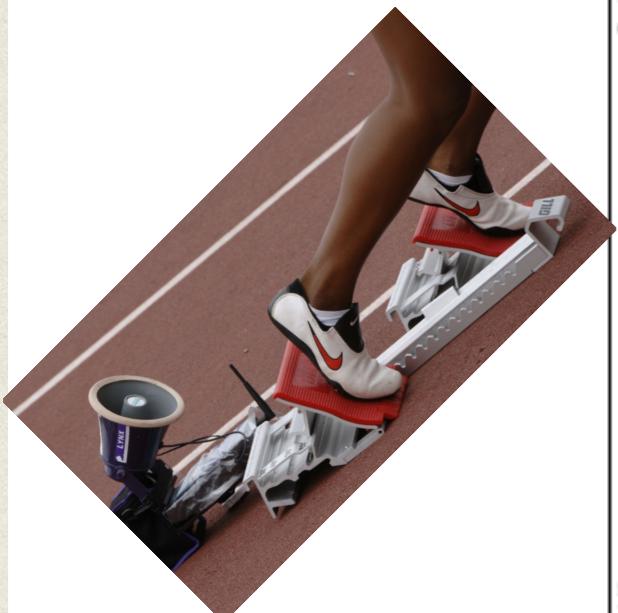
Recommendations



Recommendations

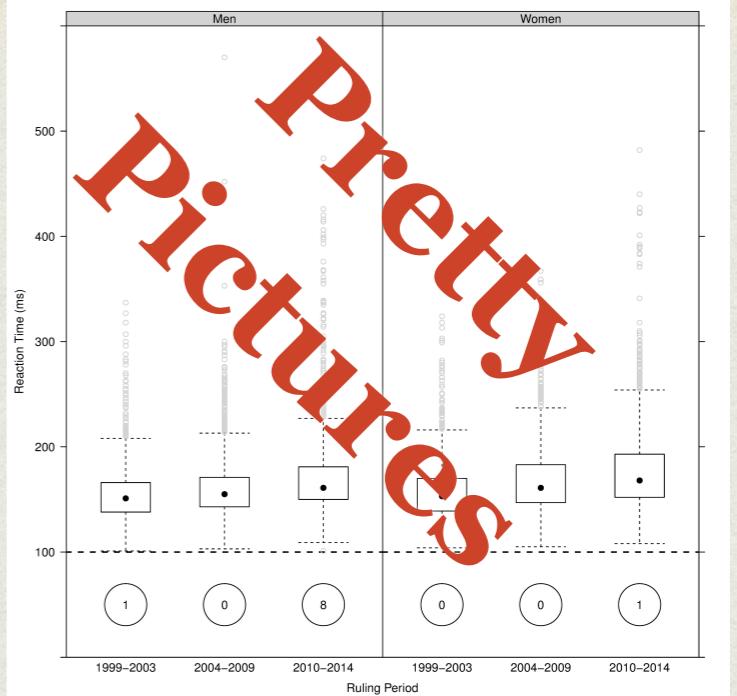


Recommendations



Competition	Sex	Event	Year	Venue	Round	Heat	Wind	Sprinter	FinishTime	ReactionTime	Result	RuleChange
Worlds	Mens	60m	2014	Sopot	1	1	NA	Gerald PHIRI	6.59	0.148	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Kimmarie ROACH	6.59	0.17	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Marvin BRACY	6.6	0.216	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Fabio CERUTTI	6.67	0.127	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Tom KLING-BAPTISTE	6.72	0.164	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Sibusiso MATSENWA	6.88	0.206	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	1	NA	Jean Thierle FERDINAND	6.98	0.158	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Bingtan SU	6.98	0.185	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Yoshinori KIRYU	6.65	0.164	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Troy GUNN	6.68	0.15	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Hughes TAFT	6.69	0.185	FastestQualifier	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Adam ZAVACKY	6.71	0.153	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Colin ROSE	6.71	0.146	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	2	NA	Mathew LAMON	7.02	0.216	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	3	NA	Jason RIVERS	6.59	0.135	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	3	NA	Warren FRASER	6.61	0.13	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	3	NA	Qimeng ZHANG	6.65	0.153	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	3	NA	Remigiusz OLSZEWSKI	6.69	0.166	FastestQualifier	2010-2014
Worlds	Mens	60m	2014	Sopot	1	3	NA	T.J. LAWRENCE	6.74	0.151	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	3	NA	Gregory BRADAI	7.3	0.187	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	3	NA	Yonder NAMELO	7.56	0.203	Eliminated	2010-2014
Worlds	Mens	60m	2014	Sopot	1	3	NA	Solomon BOCKARIE	NA	NA	DNS	2010-2014
Worlds	Mens	60m	2014	Sopot	1	4	NA	Richard KILTY	6.53	0.122	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	4	NA	Reza GHASEMI	6.58	0.156	Qualified	2010-2014
Worlds	Mens	60m	2014	Sopot	1	4	NA	Nesta CARTER	6.58	0.172	Qualified	2010-2014

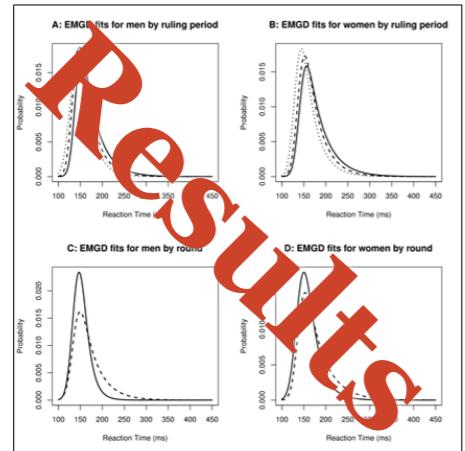
DATA



Modelling

$$f(RT|\mu, \sigma, \tau) = \frac{1}{\tau} \exp\left(\frac{\mu}{\sigma^2} - \frac{RT}{\tau}\right) \Phi\left(\frac{RT - \mu - \frac{\sigma^2}{\tau}}{\sigma}\right)$$

Recommendations



Results





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THANKS FOR LISTENING
QUESTIONS?