

# Genetic covariance components of conformation, movement and athleticism traits in Irish Sport Horses

J.L. Doyle, S. Egan, A.G. Fahey

—● [WWW.HORSESPORTIRELAND.IE](http://WWW.HORSESPORTIRELAND.IE) ●—



An Roinn Talmhaíochta,  
Bia agus Mara  
Department of Agriculture,  
Food and the Marine

# The Irish Sport Horse

- Traditionally: Irish Draught X Thoroughbred crosses
- Recently: introduction of continental Warmblood crosses
- Known for their athleticism, jumping ability, courage, intelligence, and soundness
- Compete successfully at the highest level of show jumping and eventing
- Popular leisure horses



# Linear Profiling

- Introduced in 2010
- Stallion Inspections held once a year in March
- Mare Inspections held at multiple venues throughout Spring and Autumn
- Studbook competitions throughout the summer
- Horses are scored on scale of A to I for 37 traits:
  - Conformation (n = 19)
  - Movement (n = 9)
  - Athleticism\* (n = 9)
- Profiling is undertaken by a panel of trained inspectors with one designated as the chair of the panel



# Objective

- To estimate the genetic parameters of linear scored conformation, movement & athleticism traits
- To determine their suitability for inclusion in a national genetic evaluation for sport horses



# Materials & Methods

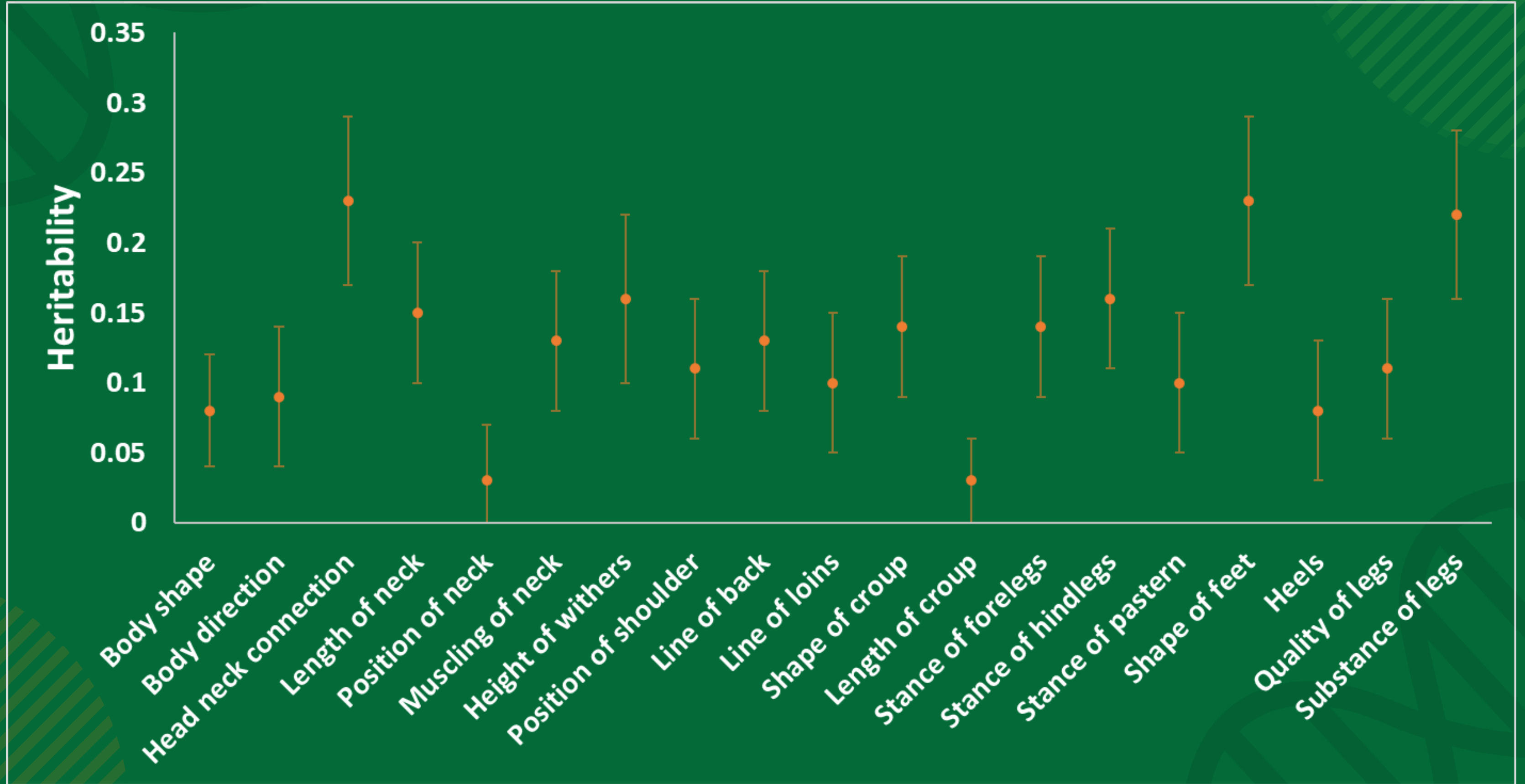
- Total: 2,354 linear profiles available
  - 1,063 from mare inspections
  - 188 from stallion inspections
  - 1,103 from records scored at competitions
- Only first record from each horse was retained
- Records were discarded if chair of the inspection panel had chaired the inspection of less than 5 horses in a calendar year
- 2,129 records remained for analysis

$$y = \text{age} + \text{sex} + \text{year} + \text{chair} + \text{animal} + e$$

# Conformation Traits

	Scale of Measurement		Number of Records	Mean	Standard Deviation	Minimum	Maximum
	1 (A)	9 (i)					
Body shape	rectangular	square	2083	3.53	0.95	1	8
Body direction	uphill	downhill	2083	6.11	0.92	2	9
Head neck connection	light	heavy	2083	5.67	0.88	2	9
Length of neck	long	short	2084	5.36	0.92	2	9
Position of neck	vertical	horizontal	2073	5.67	0.82	3	9
Muscling of neck	heavy	poor	2077	4.97	0.77	2	9
Height of withers	high	flat	2081	3.97	0.99	1	8
Position of shoulder	sloping	straight	2075	5.67	1.14	2	9
Line of back	roached	weak	2080	5.74	0.97	2	9
Line of loins	roached	weak	2080	5.36	1.06	2	9
Shape of croup	sloping	flat	2080	4.00	0.97	1	8
Length of croup	long	short	2075	4.93	1.24	2	9
Stance of forelegs	over at knee	back at knee	2077	5.43	0.72	3	8
Stance of hindlegs	sickle	straight	2073	4.35	0.99	2	8
Stance of pastern	weak	upright	2069	4.76	0.87	2	8
Shape of feet	wide	narrow	2065	4.92	0.89	1	8
Heels	high	low	2059	5.18	0.89	3	8
Quality of legs	lean	blurred	2049	5.23	0.99	2	8
Substance of legs	heavy	fine	2050	5.59	0.92	2	9

# Conformation Traits

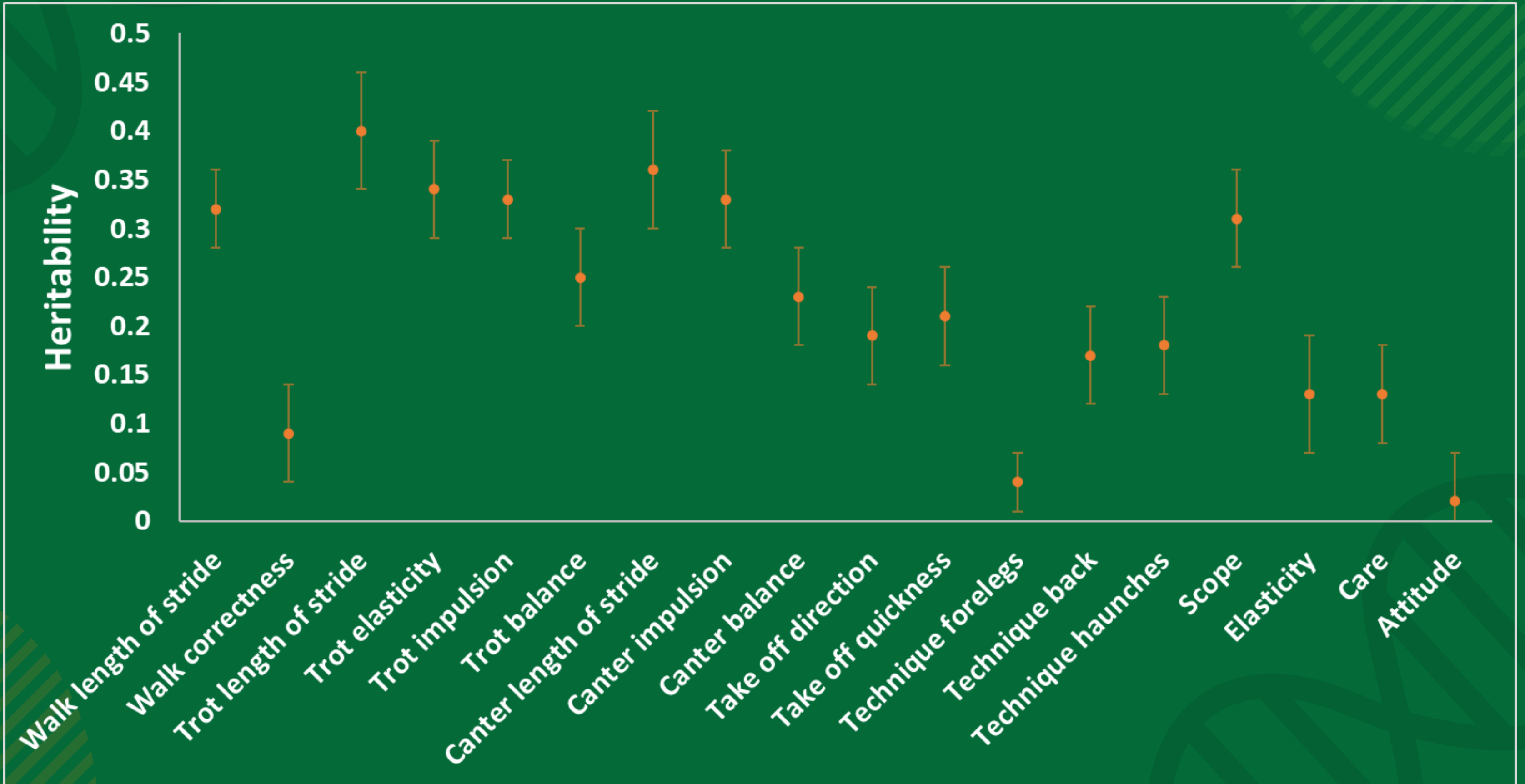


# Movement & Athleticism Traits

	Scale of Measurement		Number of Records	Mean	Standard Deviation	Minimum	Maximum
	1 (A)	9 (I)					
<b>Walk: length of stride</b>	long	short	2040	4.97	1.19	2	9
<b>Walk: correctness</b>	toed in	toed out	2045	4.84	0.74	2	8
<b>Trot: length of stride</b>	long	short	2067	5.03	1.34	2	9
<b>Trot: elasticity</b>	elastic	stiff	2067	5.12	1.36	1	9
<b>Trot: impulsion</b>	powerful	weak	2067	5.36	1.35	2	9
<b>Trot: balance</b>	carrying	pushing	2064	5.54	1.35	2	9
<b>Canter: length of stride</b>	long	short	2072	5.14	1.37	2	9
<b>Canter: impulsion</b>	powerful	weak	2070	5.6	1.36	2	9
<b>Canter: balance</b>	carrying	pushing	2068	5.74	1.39	2	9
<b>Take off: direction</b>	upwards	forwards	1630	5.48	1.5	1	9
<b>Take off: quickness</b>	quick	slow	1630	5.24	1.53	1	9
<b>Technique: forelegs</b>	bent	stretched	1627	5.05	1.54	1	9
<b>Technique: back</b>	rounded	hollow	1628	5.83	1.64	1	9
<b>Technique: haunches</b>	open	tight	1628	5.27	1.58	1	9
<b>Scope</b>	much	little	1626	5.37	1.8	1	9
<b>Elasticity</b>	supple	stiff	1626	5.61	1.69	1	9
<b>Care</b>	careful	not careful	1620	4.51	1.5	1	9
<b>Attitude</b>	much	little	1612	3.78	1.53	1	9



# Movement & Athleticism Traits



# Correlations - Movement Traits

	Walk length of stride	Walk correctness	Trot length of stride	Trot elasticity	Trot impulsion	Trot balance	Canter length of stride	Canter impulsion	Canter balance
Walk length of stride		0.02	0.54	0.45	0.44	0.39	0.46	0.38	0.37
Walk correctness	0.20		0.01	0.01	-0.02	-0.02	-0.01	-0.02	-0.03
Trot length of stride	0.92	0.08		0.75	0.72	0.61	0.61	0.51	0.46
Trot elasticity	0.80	0.08	0.99		0.85	0.76	0.55	0.63	0.57
Trot impulsion	0.87	-0.03	0.92	0.97		0.85	0.54	0.69	0.63
Trot balance	0.72	-0.06	0.97	0.91	0.99		0.49	0.67	0.69
Canter length of stride	0.87	-0.01	0.94	0.95	0.96	0.98		0.66	0.58
Canter impulsion	0.78	-0.01	0.85	0.94	0.99	0.97	0.98		0.86
Canter balance	0.85	0.01	0.93	0.91	0.94	0.88	0.99	0.98	

# Correlations - Athleticism Traits

	Take off direction	Take off quickness	Technique forelegs	Technique back	Technique haunches	Scope	Elasticity	Care
Take off direction		0.62	0.44	0.69	0.63	0.63	0.66	0.52
Take off quickness	0.86		0.48	0.6	0.58	0.64	0.66	0.47
Technique forelegs	0.54	0.51		0.46	0.42	0.35	0.56	0.44
Technique back	0.88	0.89	0.72		0.67	0.64	0.76	0.51
Technique haunches	0.98	0.89	0.15	0.88		0.67	0.68	0.50
Scope	0.95	0.92	0.37	0.86	0.99		0.72	0.47
Elasticity	0.99	0.91	0.58	0.91	0.89	0.99		0.54
Care	0.93	0.94	0.86	0.98	0.72	0.83	0.89	



# Conclusion

## Covariance components

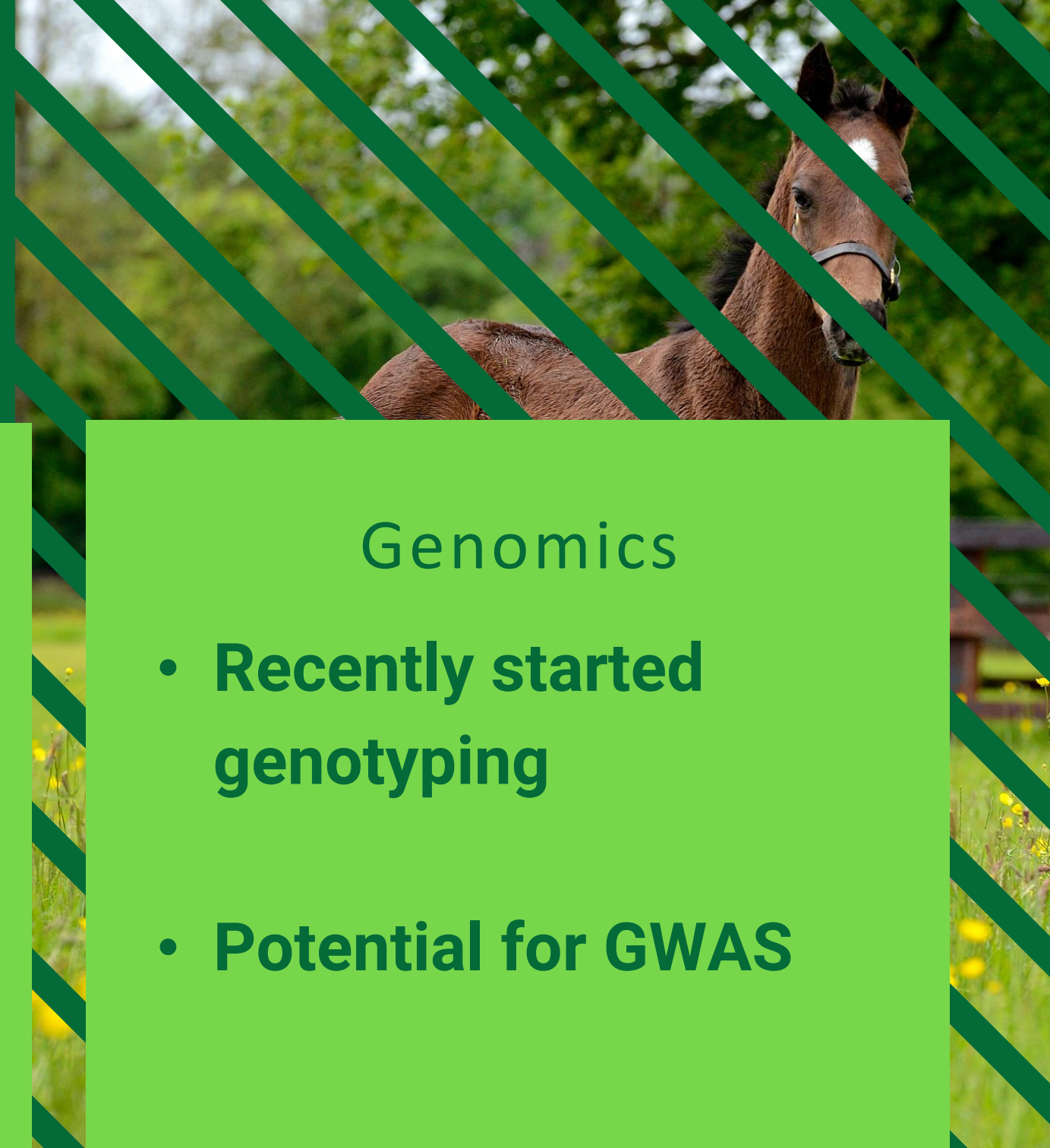
- **All traits exhibited some genetic variation**
- **Strong correlations among several traits**
- **May be useful to inform future genetic evaluations**

## Further Questions

- **Inclusion of traits scored in Irish Draught horses?**
- **How do these traits correlate with performance?**

## Genomics

- **Recently started genotyping**
- **Potential for GWAS**



# ••• Acknowledgements



An Roinn Talmhaíochta,  
Bia agus Mara  
Department of Agriculture,  
Food and the Marine



**HORSE SPORT**  
**IRELAND**

