



UNIVERSITÀ DI PARMA



Objective movement assessment in horses: First results from using sensor technology in Italian horses

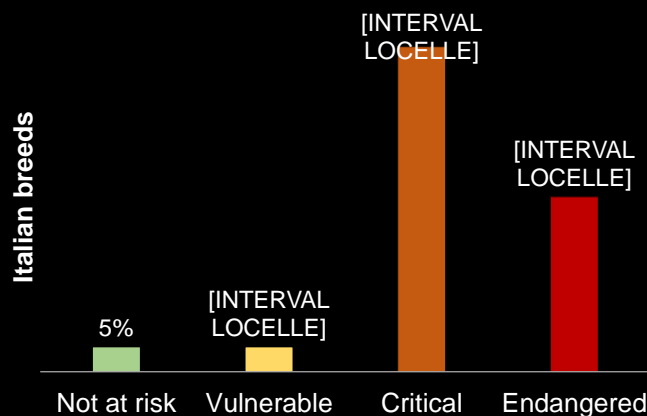
V. Asti, M. Ablondi

Department of Veterinary Science, University of Parma (Italy)



Italian horse heritage

- Over 20 local horse breeds
- No extinct breed so far
- Over 90% them either at critical or endangered status



How to safeguard local breeds in the long term?

Genetic diversity management

Maintain distinctiveness while
adapting to current market demand



Bardigiano



Trait	Breed Standard
Height at withers	135 – 149 cm
Chest circumference	165 – 180 cm
Shoulder length	55 - 65 cm

Murgese



Trait	Breed Standard
Height at withers	150 - 170 cm
Chest circumference	180 – 200 cm
Shoulder length	65 – 75 cm

Aim of the study

Use of novel tools to objectively measure movements



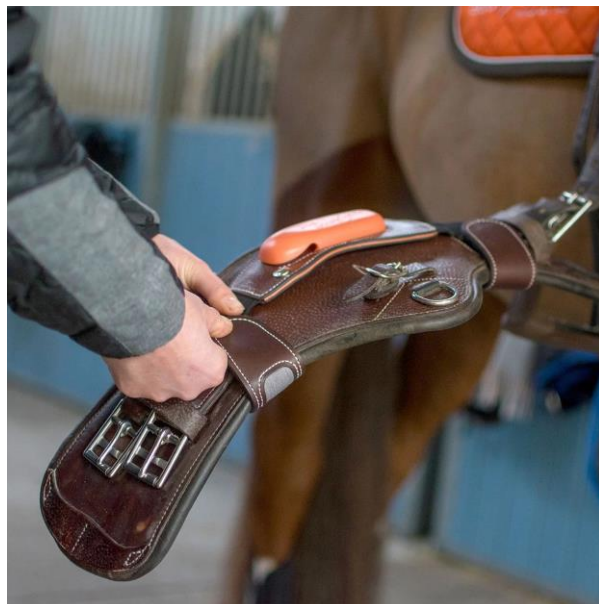
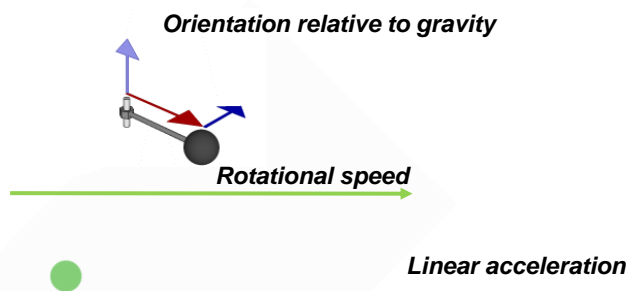
Equisense Motion S

**Inertial measurement units (IMUs) system
and
Electrodes**

+ Phone connection for GPS

9-axis motion sensor:

- Accelerometer (3 axes)
- Gyroscope (3 axes)
- Magnetometer (3 axes)

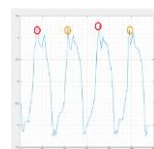


Derived phenotypes based on IMU system:

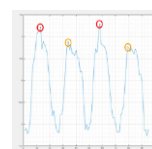
1) Symmetry at trot in a straight line (/10)



Symmetry



Symmetrical



Asymmetrical

2) Impulsion per gait (cm)



Impulsion

5,6 /10
Note



-1,1
Évolution

3) Cadence per gait (strides/minute)



Stride
Frequency



Walk 1.8 cm
Trot 9.9 cm
Canter 18.0 cm

4) Stride regularity (/10)



Stride
Regularity



Gait Speed

Via phone GPS

Electrodes

Heart rate measured every 2 seconds

Derived phenotypes based on electrodes:



Heart Rate per
Gait



Recovery Time



Energy
Expenditure



When and how?

- During a 10-weeks training program (70-day test)
- 3- or 4-years old horses
- Developing a specific protocol tested at 30 and 70 days

Preliminary results on roughly 100 observations in the Bardigiano and Murgese



Symmetry



Stride Frequency



Recovery Time

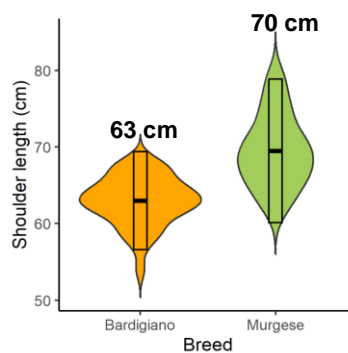
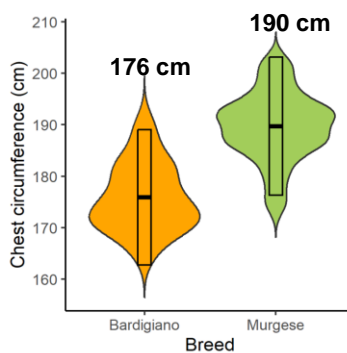
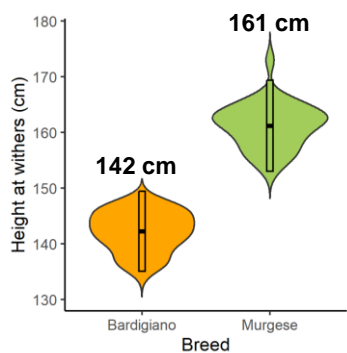
Movements		
1	A X C	Enter in trot Halt – immobility – salute Proceed in trot Track to the right
2	Da M a M	Proceed in trot
3	MXK	Diagonal (trot)
4	Da K a K	Proceed in trot
5	Tra A e F	Transition at left canter
6		Two laps on track at left canter
7	M	Transition at trot
8	MCH	Trot
9	HXF	Diagonal (trot)
10	Tra A e K	Transition at right canter
11		Two laps on track at right canter
12	H	Transition at trot
13	HCM	Trot
14	MXK	Diagonal (trot)
15	A	walk
16		Two laps on track at walk
17	A X	Down the center line Halt – immobility – salute

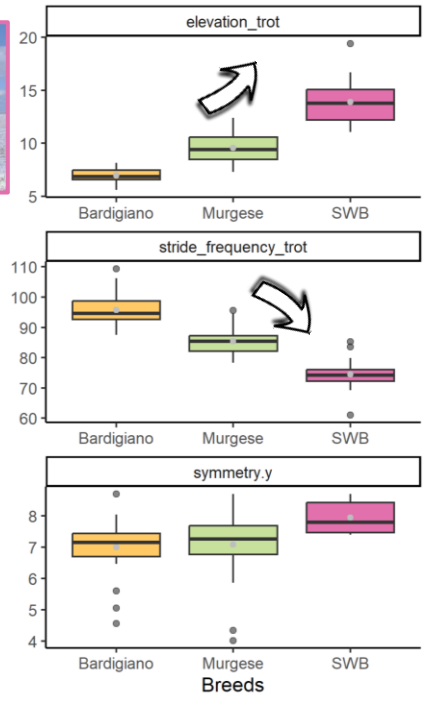
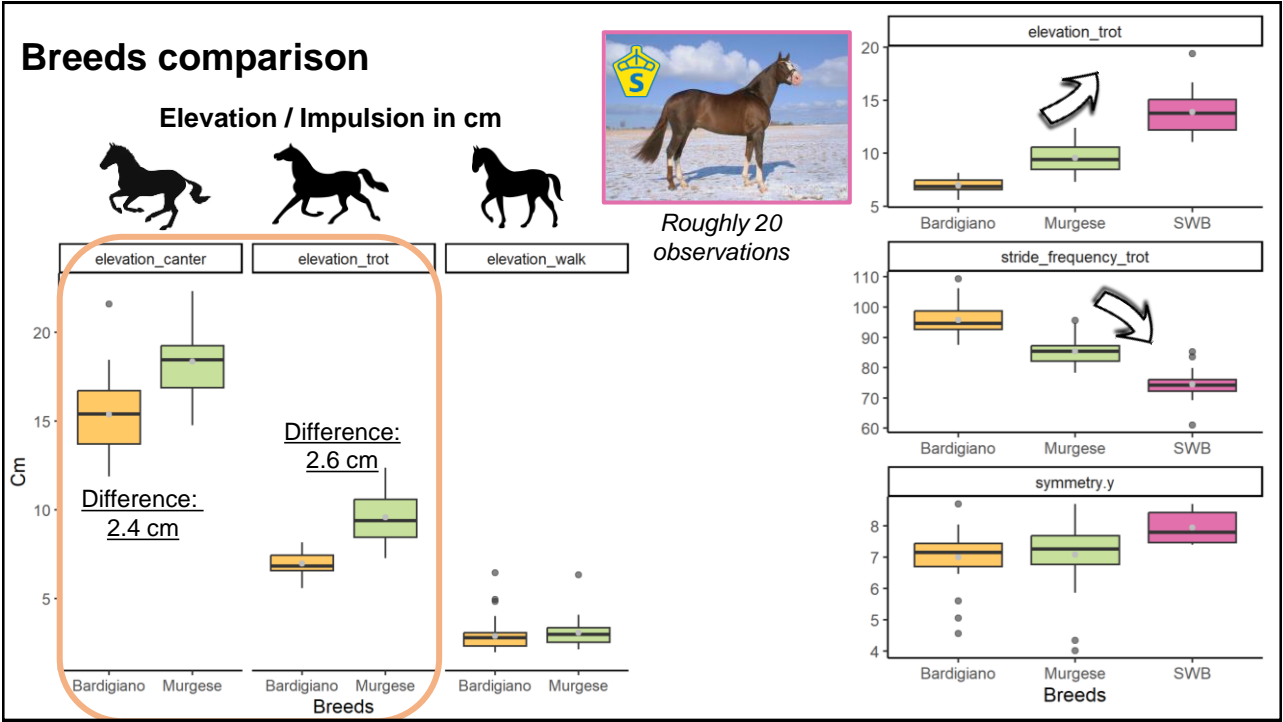
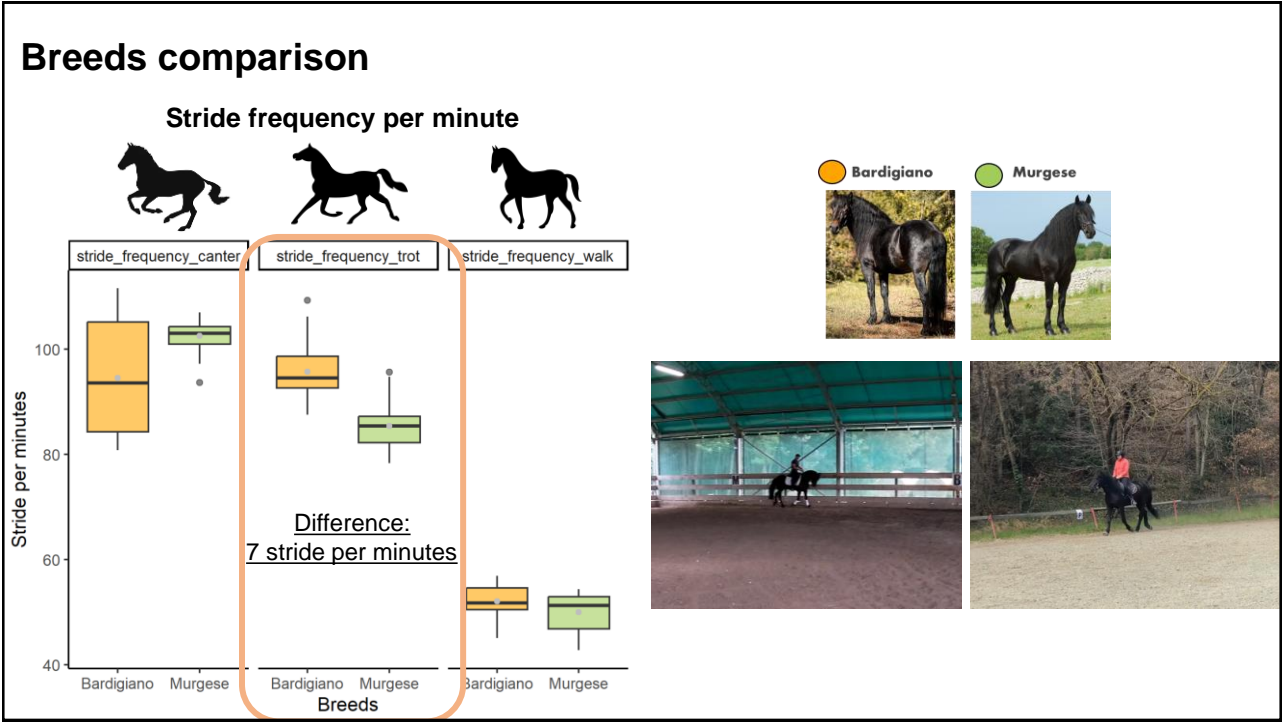
Overview of sampled horses

 Bardigiano

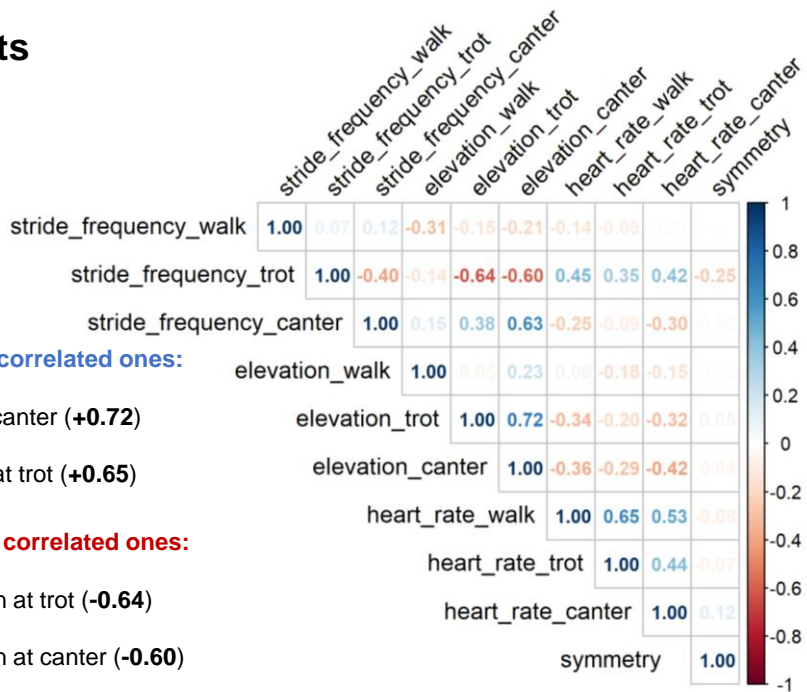


 Murgese





Correlation among traits



Focus on the two most positively correlated ones:

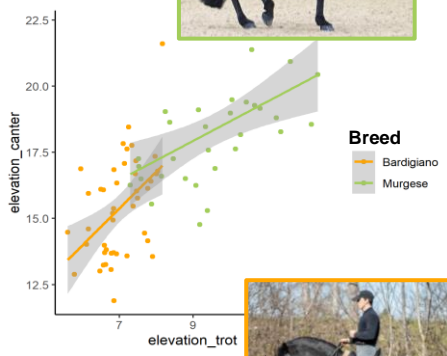
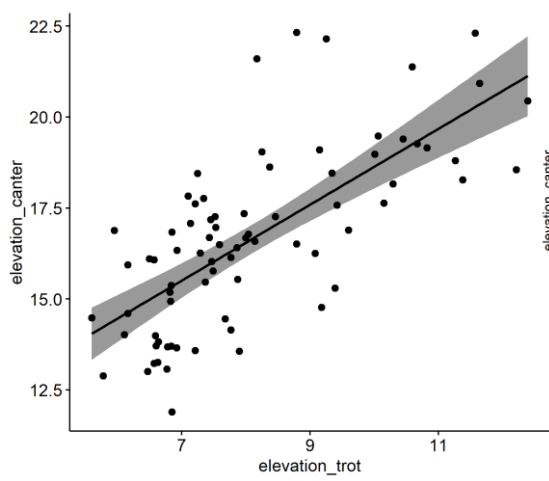
- Elevation at trot and elevation at canter (+0.72)
- Heart rate at walk and heart rate at trot (+0.65)

Focus on the two most negatively correlated ones:

- Stride frequency trot and elevation at trot (-0.64)
- Stride frequency trot and elevation at canter (-0.60)

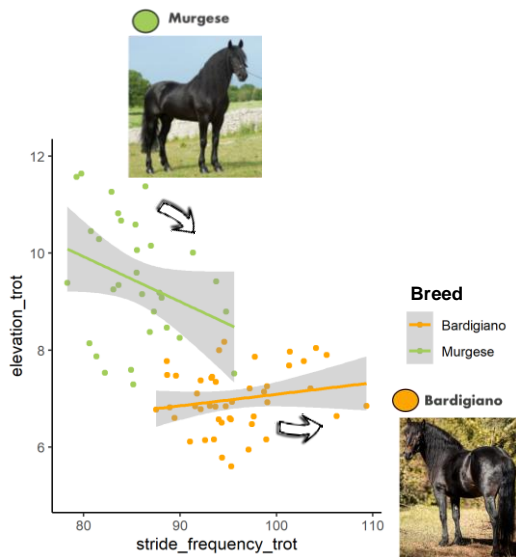
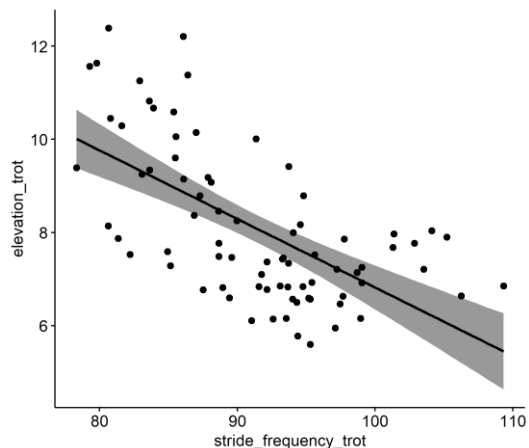
Correlations among traits

1) Elevation at trot and elevation at canter (+0.72)



Correlations among traits

2) Stride frequency trot and elevation at trot (-0.64)



Correlations with official evaluations

Official protocol used by breed experts



Progetto Equibio - PSNR - Sottomisura 10.2
 INDICAZIONI SULL'USO E VALUTAZIONE CONNATIVE;
 CALCOLO DELL'INDICE DI VALUTAZIONE CONNATIVA;
VALUTAZIONI ATTIBD/NAI - SOGGETTI IN STAZIONE DI
PROVA AD AMBIENTE CONTROLLATO

NOME: _____ Matr. I.C. _____ Anno di nascita: _____

TRAPUNTA SINGOLA	CARATTERISTICA DA VALUTARE	VALUTAZIONE INTERMEDIA A 30 GGI DA INIZIO IN DATA	VALUTAZIONE FINALE A 60 GGI DA INIZIO IN DATA
Lavoro	1- GOVERNO ALLA MANO, GESTIONE SCOSTORSA DEL BOS.		
	2- ACCETTAZIONE BARRIERE, IMPAZIONE AL PASSAGGIO, SOLIDITÀ NELL'APPROCCIO AL CAVALELLO ANTIBRACCIO.		
	3- TECNICA SUL SALTO: PASSAGGIO SCOSTORSA.		
	4- CARATTERISTICA, RISPOSTA AI COMANDI DEL CAVALIERE, VOLONTÀ DI COSTITUIRE AL LAVORO.		
Moto	5- TROTTO: RITMO, IMPULSO, AMPIEZZA, ELASTICITÀ E REGOLARITÀ.		
	6- GALOPPO: RITMO, IMPULSO, AMPIEZZA, ELASTICITÀ E REGOLARITÀ.		
	7- CANTER: RITMO, ELASTICITÀ E POLSICA VIBRO AL CAVALELLO IN STATO DI LAVORO.		
	8- AFFINZIONE ALLE RICHIESTE - CONFORMAZIONE NEGLI ESERCIZI.		
Salti	9- SALTO IN LIBERTÀ.		
	10- LAVORO IN PUNTO.		
	11- PRIMA DI ATTACCO.		

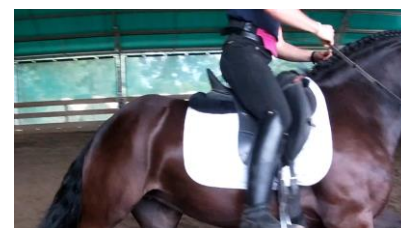


- **6 Trot:** rhythm, elevation and elasticity of the movements
- **7 Canter:** rhythm, elevation and elasticity of the movements

Correlations with official evaluations

- 6 Trot: rhythm, elevation and elasticity of the movements
- 7 Canter: rhythm, elevation and elasticity of the movements

	6	7	stride_frequency_walk	stride_frequency_trot	stride_frequency_canter	elevation_walk	elevation_trot	elevation_canter	heart_rate_walk	heart_rate_trot	heart_rate_canter	symmetry.y
6	1.00	0.81	0.15	-0.16	0.44	0.10	0.26	0.29	-0.22	-0.17	-0.38	0.06
7	1.00	0.04	-0.07	0.56	0.11	0.27	0.49	-0.21	-0.05	-0.26	0.03	



Conclusions

- Equisense can be used during 10 weeks training program
- It can differentiate among breeds as well as among animals
- Traits are sometimes differently correlated depending on the studied breed
- Some traits seems to be moderately correlated with official evaluation
- No information available on specific legs phenotype (protraction etc.)





**Thank you for listening and thanks
Vittoria for all the hard work!!**