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SCHWEINE-
GENERATION
von morgen

Recording of new phenotypes in pigs

Irene Häfliger

ETHZ, SABRE-TP 11. January 2024

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Recording behaviour of sows

Behaviour of pigs

Aggressive behaviour

Social behaviour

Reproductive behaviour

Feeding behaviour

Mother-child interaction

Behaviour of pigs

Aggressive behaviour

Social behaviour

Reproductive behaviour

Feeding behaviour

Mother-child interaction

Behaviour of pigs

Aggressive behaviour

International project: Aggression in pigs

International Project: Aggression in pigs

- Collaborators: Schottland Rural College (SRUC) and University of Edinburgh
  - PhD-Student: Nicole Maffezzini

Goals: Developement of tools to record and evaluate behaviour to improve animal welfare and workplace safety

- Animals of interest:
  - Breeding sows in the farrowing pen and group pens during gestation
  - Young boars in the test station
- Investigations of interest:
  - Variation in phenotypes
  - Genetic evaluations: heritabilities & genetic correlations
  - Applications in breeding

collected CH data during 3 months in 2023

Mother abilities in farrowing pens I

Separation test: taking a piglet away from the sow

- Assesses the sensitivity of a lactating sow to the separation of a piglet
- Duration: ~1 min
- A tactile stimulus (a rubber glove on the bar)

Mother abilities in farrowing pens I

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- Assesses the sensitivity of a lactating sow to the separation of a piglet
- Duration: ~1 min
- A tactile stimulus (a rubber glove on the bar)

- Scoring based on posture, temperament and vocalisation

Scoring	Description
1	No reaction
2	Sits up / stands up, but does not react aggressively, may grunt.
3	Stands up, can approach practively, a relatively defensive reaction, squeaks or barks.
4	Stands up, a strong defensive reaction, bites the rubber glove, squeaks or barks very loudly.
5	Stands up quickly, extremely aggressive reaction, bites the rubber glove before the piglet screams, squeals or barks frequently and extremely loud.

Mother abilities in farrowing pens I - examples

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Mother abilities in farrowing pens II

Pigglet-scream test: acoustic signal from crying piglets

- Assesses the reaction of a lactating sow to the sound of a screaming piglet (from speaker)
- Duration: ~1 min
- Active sows → reduced suckling piglet losses

Mother abilities in farrowing pens II

Pigglet-scream test: acoustic signal from crying piglets

- Assesses the reaction of a lactating sow to the sound of a screaming piglet (from speaker)
- Duration: ~1 min
- Active sows → reduced suckling piglet losses

- Scoring based on posture, temperament and vocalisation

Scoring	Description
1	No reaction
2	No change of position, does not react aggressively, some vocalisation (squeaking).
3	Change of position before the end of the test, mediocre reaction, sniffs/looks at piglets, squeaks or even screams frequently.
4	Stands up (in 20 sec), strong defensive reaction, looks at her piglest, squeaks or creams very loudly.
5	Stands up quickly (in 10 sec), extremely aggressive reaction even when testing other sows, squeals or screams extremely loud.

Mother abilities in farrowing pens II - examples

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Outlook → Data analysis

Answering research questions:

1. Is there variation in the data collected from the described tests?
2. How heritable are the behavioural traits? How strongly do they correlate phenotypically and genetically?
3. How can we implement these tests in practice? Do we need adaptations for the implementation?
4. Is breeding possible based on the results of questions 2) and 3)?

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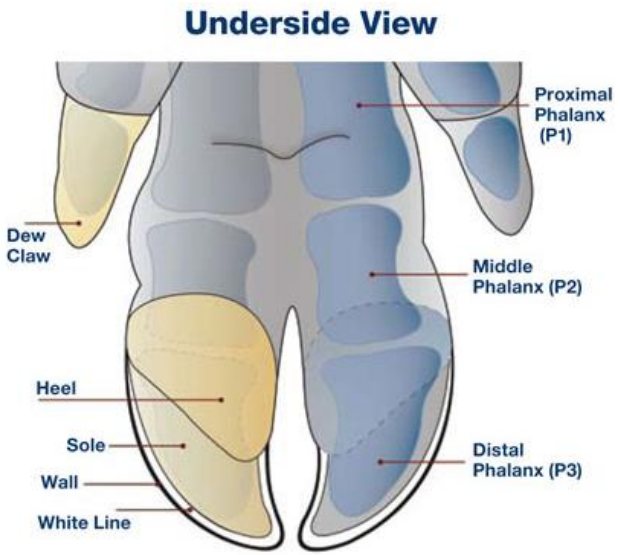
Digital measurement of phenotypes regarding foot health

Phenotypes regarding foot health

- Basic idea: **sustainable promotion of foot health by means of objective phenotypes for the breeding programm**

What we want



- Symmetric feet
- steady stand and stances
- Painless walk

What we do NOT want

- asymmetric feet
- Irregular stances
- Weak stands
- limping walks

(Bilder aus https://americanminipigassociation.com/wp-content/uploads/2015/01/underside-pig-toe-11-15.jpg und Semesterarbeit zur Klauengesundheit von Ursula Tröhler, HAFL, 2018)

What is currently done?

- **Linear description of a variety of phenotypes → included in breeding program**
  - 80-120kg animals from the test station & breeding animals on farms
  - Linear scale from 1 to 7
  - Optimum is 4

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  - Based on the hind legs:
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    - Sabre- or chair-legged
    - Shackle: soft or steep
    - Inner claw shortened or enlarged
  - Based on the front legs:
    - Bent back or bent forward

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			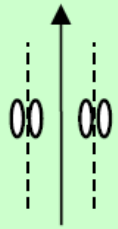		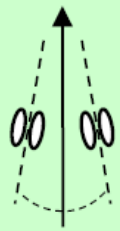	
> 20°	< 20°	< 10°	parallel	< 10°	< 20°	> 20°

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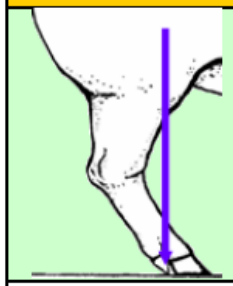			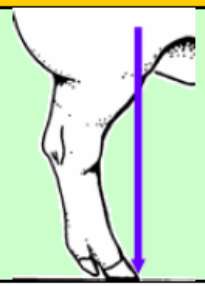			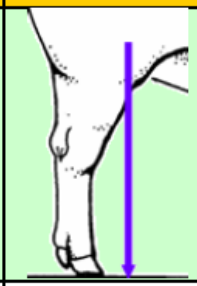
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> 6 cm	3 - 6 cm	0 - 3 cm	Opt.	0 - 3 cm	3 - 6 cm	> 6 cm

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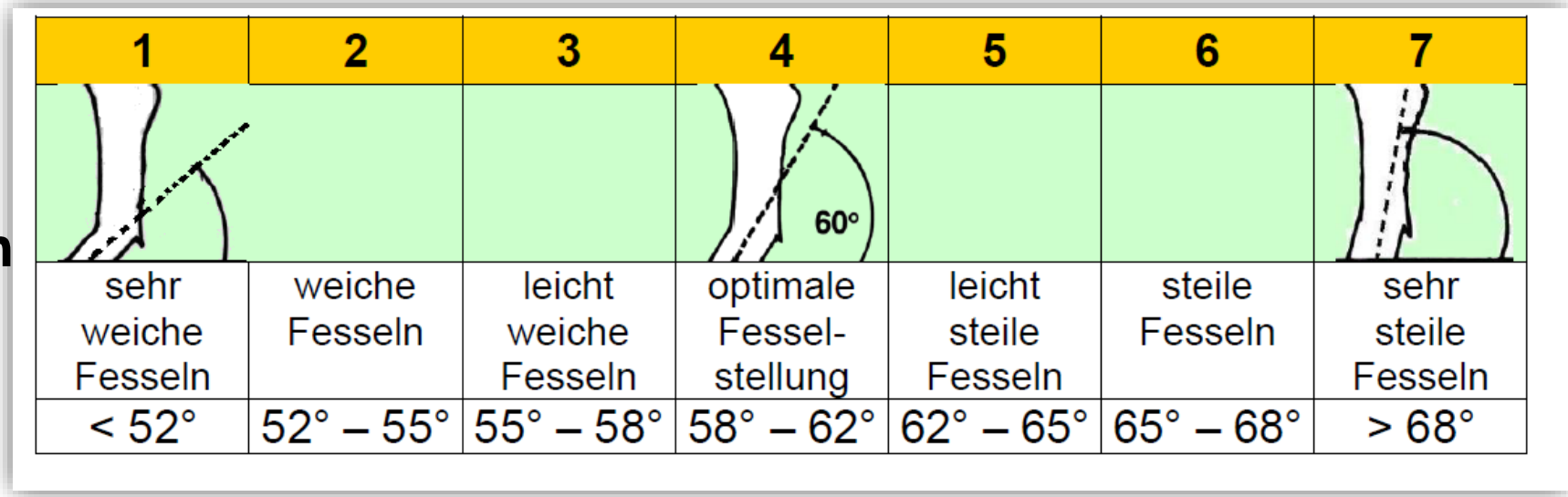

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> 1 cm	0.5 – 1 cm	< 0.5 cm	gleich lang	< 0.5 cm	0.5 – 1 cm	> 1.0 cm

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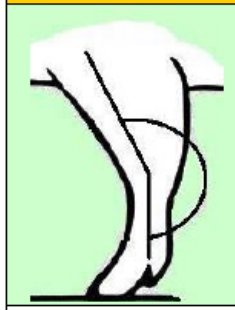						
sehr stark gebeugt	stark gebeugt	leicht gebeugt	gerade	leicht vorbiegig	stark vorbiegig	sehr stark vorbiegig
< 174°	174-177°	177-180°	180°	180-183°	183-186°	> 186°

Why is this not good enough?

- The scale makes it hard to quantify a phenotype → quite subjective
- Large effect of the technicians assessing the pigs → low heritability
- Phenotypic Variation ranges from 1-7 → no normal distribution
- Complaints from farmers → no visible improvements in the last years

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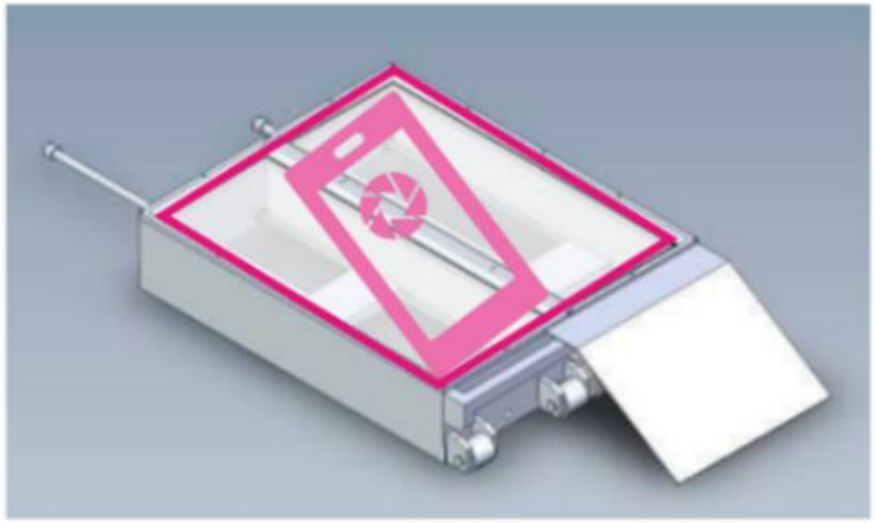
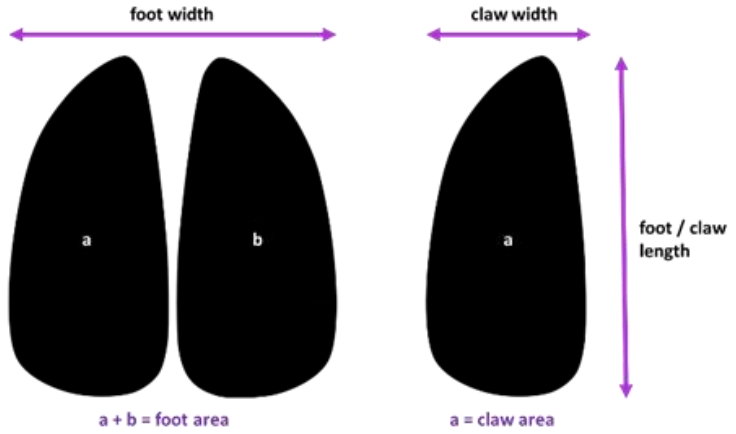
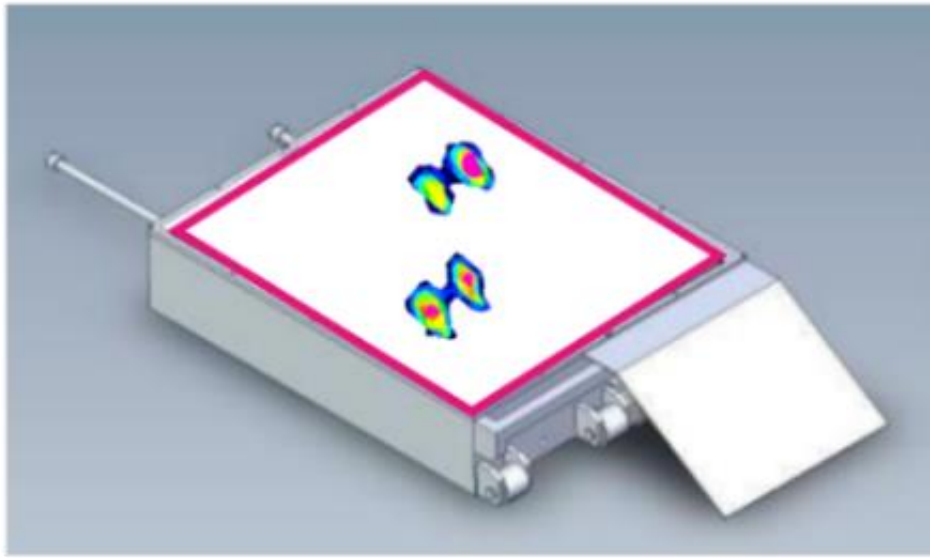
Need to do better

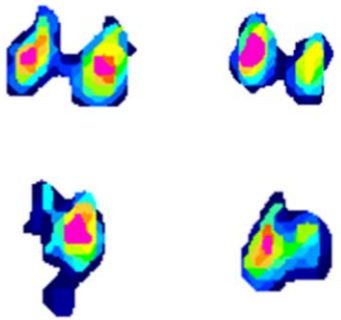
Project started: automated recording of foot health traits

Ideas to measure phenotypes





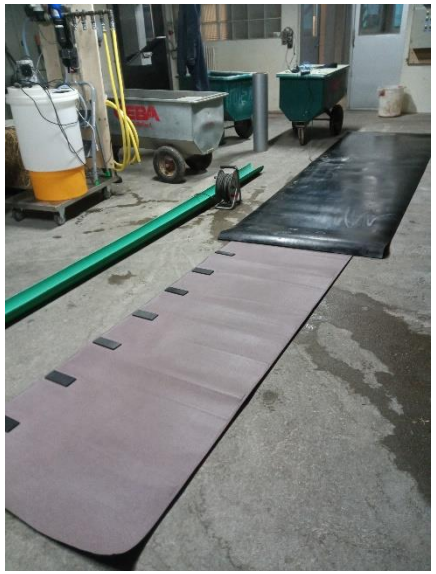


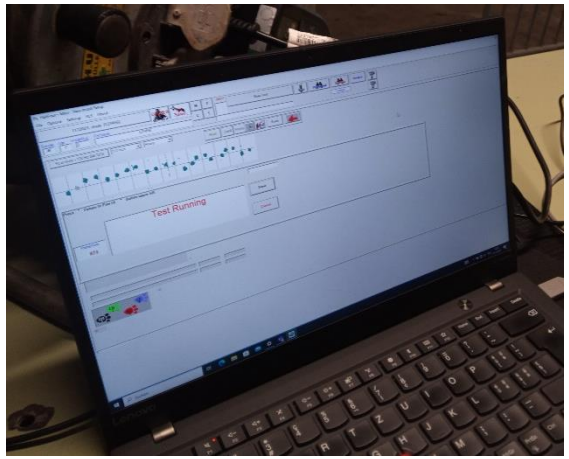


- pressure distribution
- peak pressure
- bodyweight distribution

Ideas to measure phenotypes

- **Pressure distribution while walking**
  - Rented Gait4 system of the company GaitRite
  - Pressure mat to analyse walks
  - Few small trials run





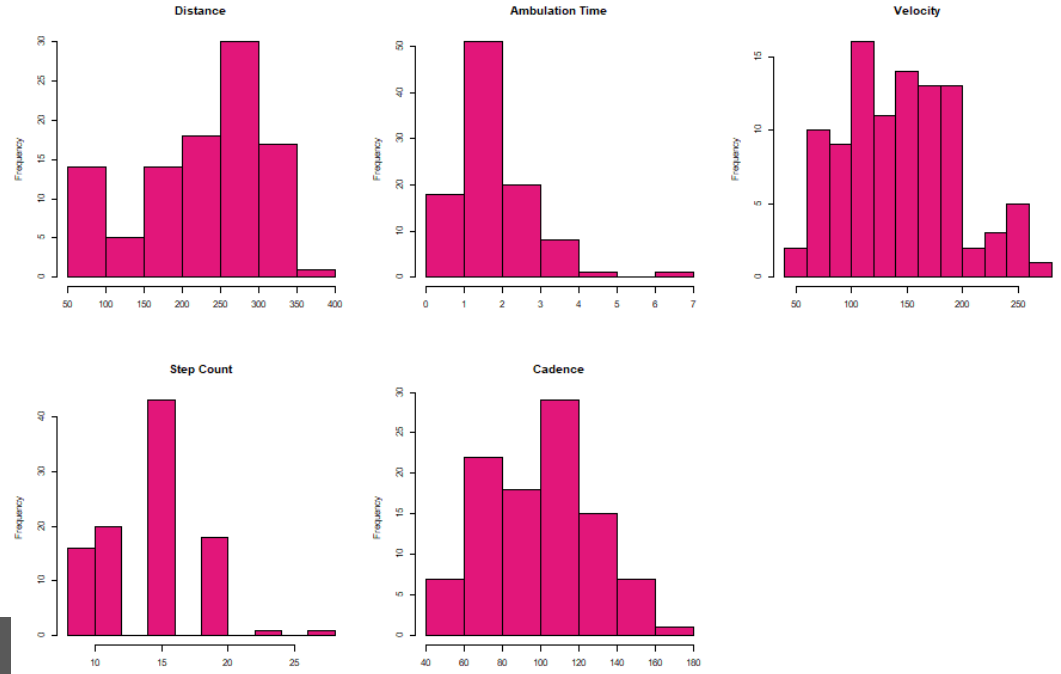
Pilot study with fattening pigs at MLP

- **Setup:**

- **Trial:** 32 animals with walking on the pathway 3 times
- System measures 46 phenotypes, e.g.:
  - Distance, abulation time, velocity, step count, candence
  - Phenotypes per leg: Step time and length; stride time and length; cyle, swing and pressure time; etc.
  - Symmetry phenotypes: total and scaled pressure index, lameness score, hind reach, etc.

First results: repeatability

	N missing	Compl. Rate	mean	SD	p0 / Min	p25	p50	p75	p100 / Max
Distance	0	1	226.1	79.6	64.8	168.0	246.4	280.0	362.6
Ambulation time	0	1	1.8	1.0	0.4	1.2	1.6	2.2	7.0
Velocity	0	1	143.9	51.0	51.8	106.5	140.9	177.1	273.5
Step count	0	1	14.8	4.2	8.0	12.0	16.0	16.0	28.0
Cadence	0	1	99.8	26.8	50.8	77.6	103.0	118.0	165.1



First results: repeatability

	lmer()		rpt()	
	R	SE	R	P
Distance	0.023	8.315	0.023	0.467
Ambulation time	0.519	0.154	0.519	3.02E-07
Velocity	0.515	7.726	0.515	2.84E-07
Step count	0.189	0.511	0.189	0.049
Cadence	0.566	4.166	0.566	2.08E-08

Some phenotypes have extremely low but other rather high repeatabilities

Outlook

Gait4

- Continue analysing collected data
- Running a long term trial:
  - A year
  - Measuring hundreds of animals
  - Perform quantitative genetic validations

Other ideas

- Implement prototypes
- Run some pilot studies

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VIELEN DANK!

<< Gemeinsam für die **SCHWEINE-GENERATION** von morgen

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