Genetic background of behaviour measured in Swedish tests DMA and BPH

Erling Strandberg[1], Helena Frögeli[2] and Sofia Malm[2]

[1]Department of Animal Breeding and Genetics, SLU [2]Swedish Kennel Club

Introduction DMA and BPH

- Dog mentality assessment (DMA) since 1989
- Working dogs in Sweden need to attend DMA before breeding
- Although intended for breeding, there are no breeding values available, only phenotypic values
- DMA was developed mainly for working dogs
- There has been an increasing demand for a behaviour assessment suitable also for other breeds.
- A new behaviour and personality assessment in dogs (BPH) was created and started in 2012.
- The Swedish Kennel Club wants to introduce BLUP breeding values for mentality traits for both DMA and BPH

Aim

- Define (a few) behavioral traits useful for routine genetic evaluation
- Estimate genetic parameters for these traits
- 12 working dog breeds (DMA)
  - Australian shepherd
  - Boxer
  - Briard
  - Collie (rough)
  - Doberman
  - German shepherd
  - Hovawart
  - Kelpie
  - Malinois
  - Rottweiler
  - Giant schnauzer
  - Terveuren

Aim

- Define (a few) behavioral traits useful for routine genetic evaluation
- Estimate genetic parameters for these traits
- 12 working dog breeds (DMA)
- 5 breeds from BPH
  - Rhodesian Ridgeback (RR)
  - Labrador Retriever (LR)
  - Nova Scotia Duck Tolling Retriever (NSDTR)
  - Staffordshire Bullterrier (SBT)
  - American Staffordshire Terrier (AST)

Material and Methods DMA

- DMA scores from Jan 1997 to Sep 2016
- 10 subtests – 33 behavioural reaction scores, 1-5
- Intensity of reaction, no value judgement
- From 1700 dogs for BRI, KEL to 22 000 for GSD

Material and Methods DMA

- Exploratory factor analysis on 33 scores to guide the definition of (fewer) traits
- Six traits were defined:

- Sociability (SOC)
- Playfulness (PLAY)
- Chase-proneness (CHASE)
- Curiosity/Fearlessness (CUR)
- Aggressiveness (AGGR)
- Gunshot avoidance (GUN)

Material and Methods

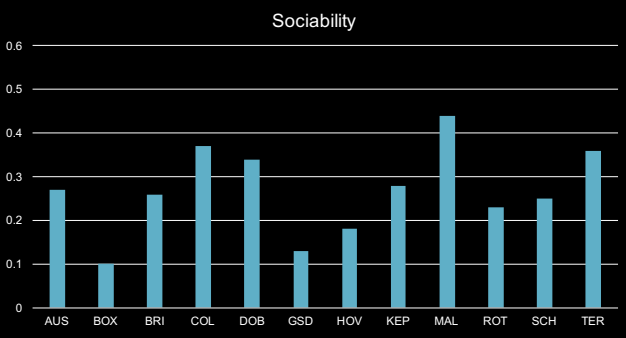
- Heritabilities and genetic correlations were estimated using an animal model:
- y = sex + test-year + test-month + age + litter + observer + occasion + animal (EBV) + e
  - fixed and random

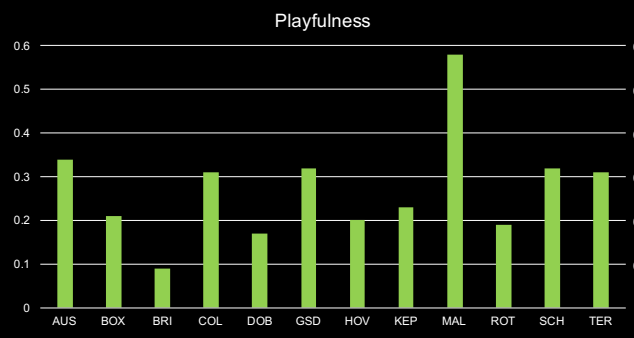
Results DMA

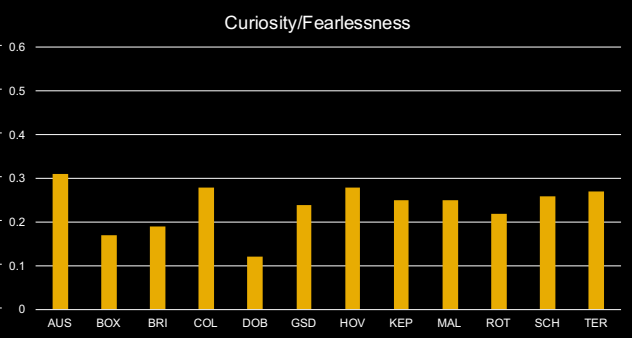
- Variance proportions:
  - Litter 2-4%
    - highest for Playfulness
  - Observer : 3-7%
    - highest for Sociability and Aggressiveness
  - Occasion: 4-9%
    - highest for Chase-proneness

Heritabilities DMA

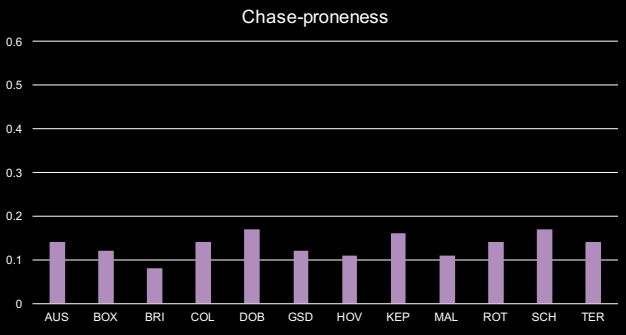
- Sociability, Playfulness, Curiosity: average 0.25

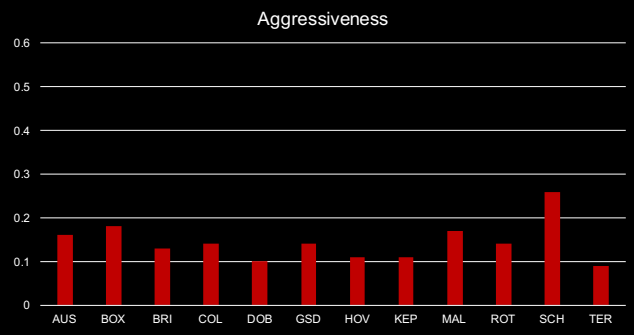


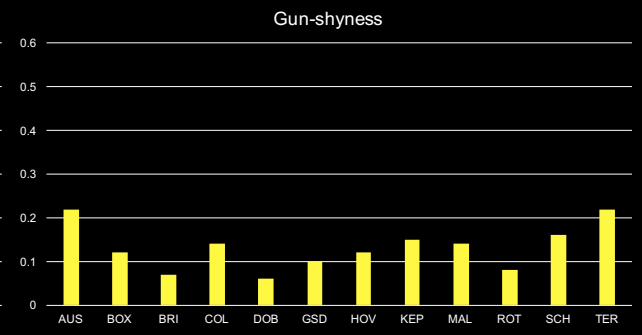




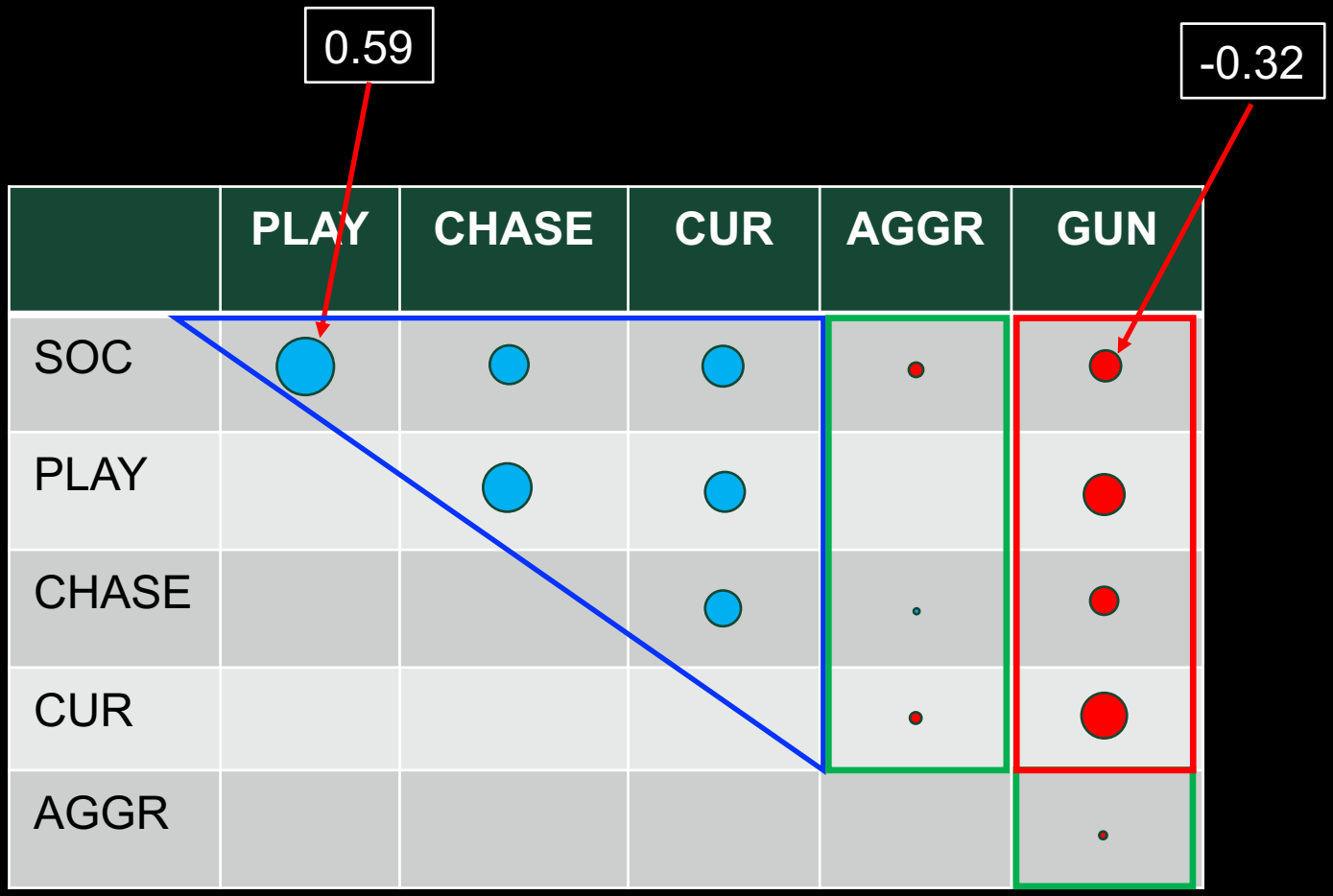
- Chase-proneness, Aggressiveness, Gunshot-avoidance: average 0.13







Genetic correlations (average across breeds) DMA



Material and Methods BPH

- 5 breeds from BPH
  - Rhodesian Ridgeback (RR)
  - Labrador Retriever (LR)
  - Nova Scotia Duck Tolling Retriever (NSDTR)
  - Staffordshire Bullterrier (SBT)
  - American Staffordshire Terrier (AST)

Definition of traits BPH

- 6 traits from BPH
  - Sociability
  - Playfulness
  - Confidence
  - Hostility

Behavioral ratings

  - Curious and Confident
  - Positive and Energetic

Subjective ratings

Material and Methods BPH

- Potential explanatory factors were tested:
- y = (breed) + sex + test-year + age + (arranging_club + test leader + observer) + animal (EBV) + e
  - fixed and random

Model development BPH

Percent variance explained by:

Trait	Arranging club	Test leader	Observer
Sociability	2.8	4.8	5.7
Playfulness	6.5	7.4	5.9
Confidence	6.8	7.6	12.4
Hostility	1.7	2.5	2.9
Curious and confident	2.4	5.8	6.0
Positive and energetic	6.8	6.7	12.6

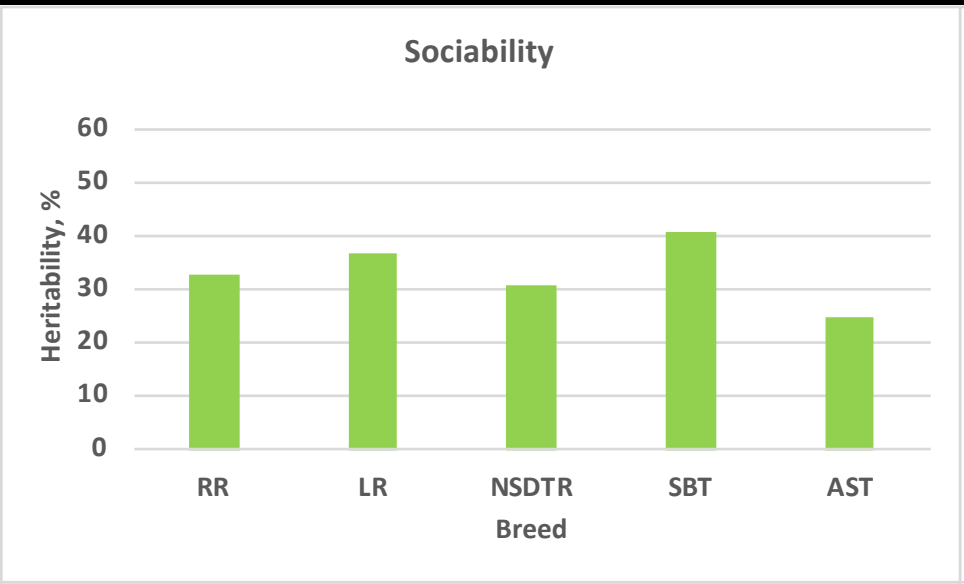
- Observer generally explained more than test leader > arranging club
- Arranging club and test leader/observer are largely confounded as are test leader with observer
- Probably best to have only observer in model
  - Adding arranging club explained less than 1% more

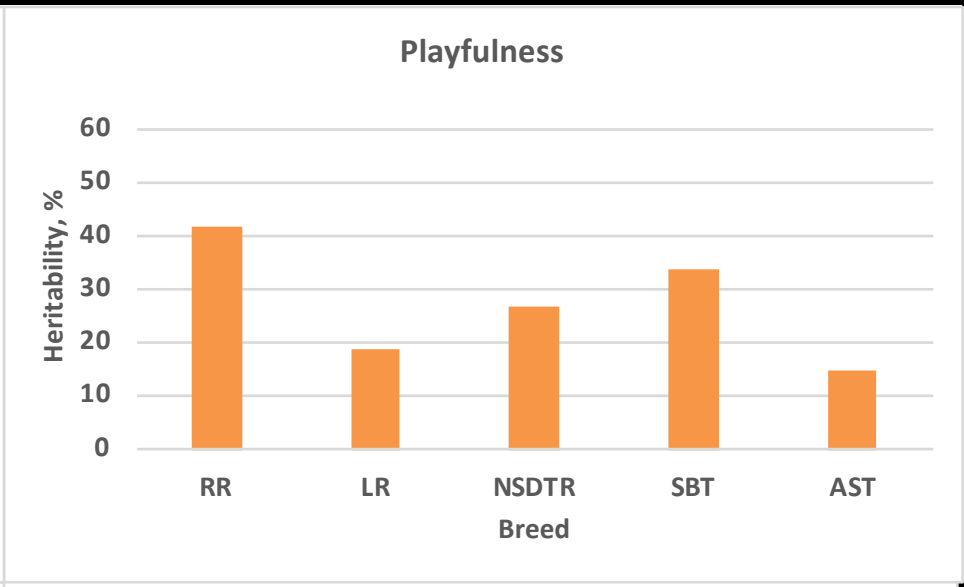
Material and Methods BPH

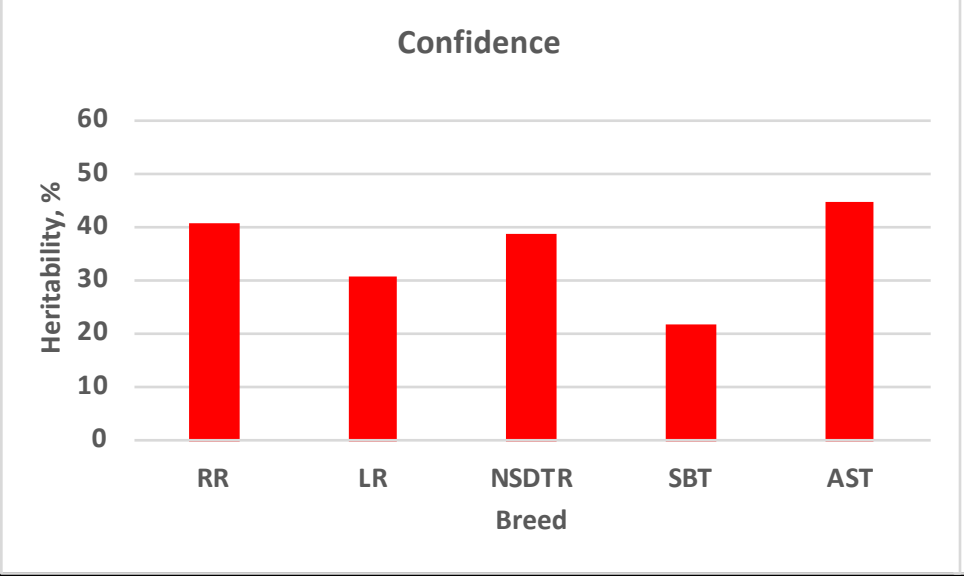
- Heritabilities and genetic correlations were estimated using an animal model:
- y = sex + test-year + age +

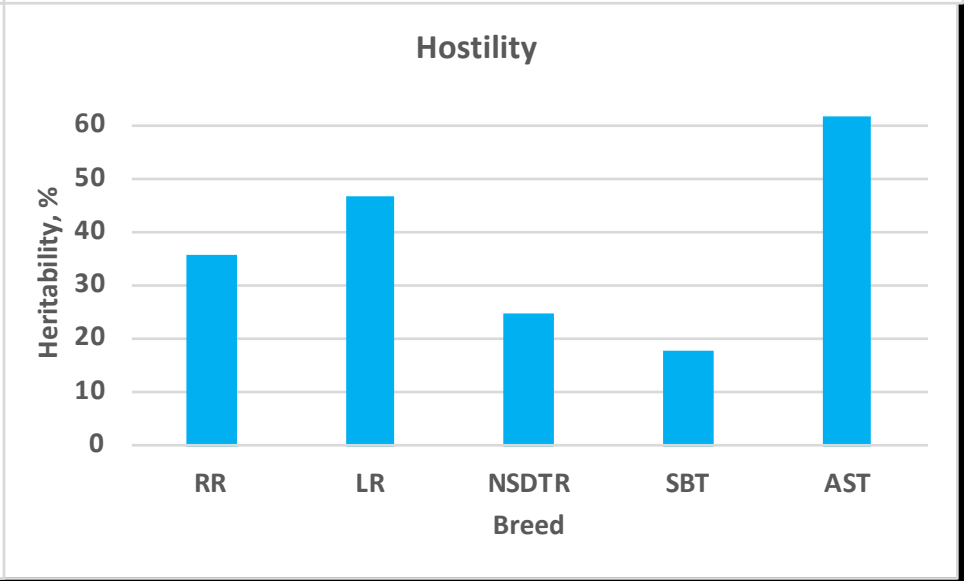
  observer + animal (EBV) + e
  - fixed and random

Heritabilities BPH

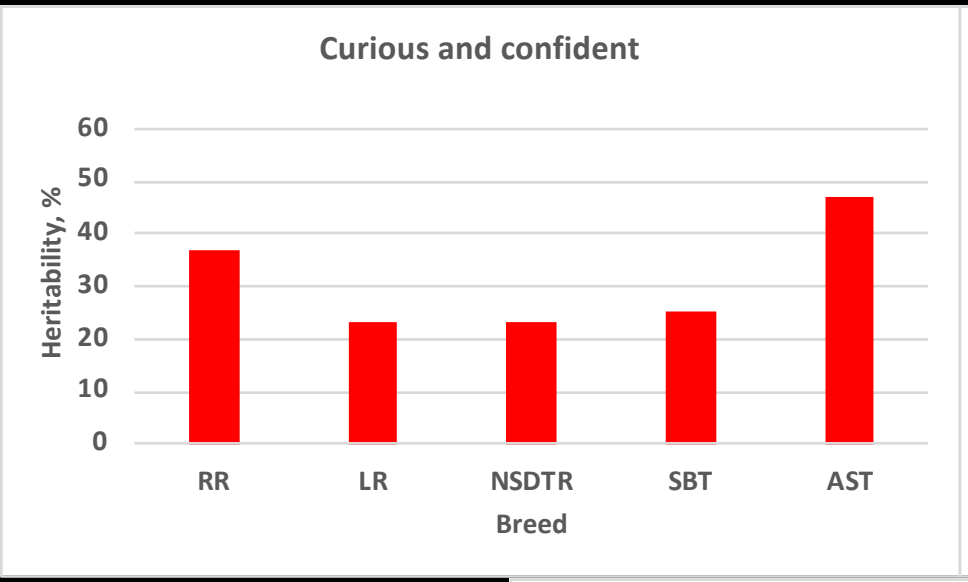


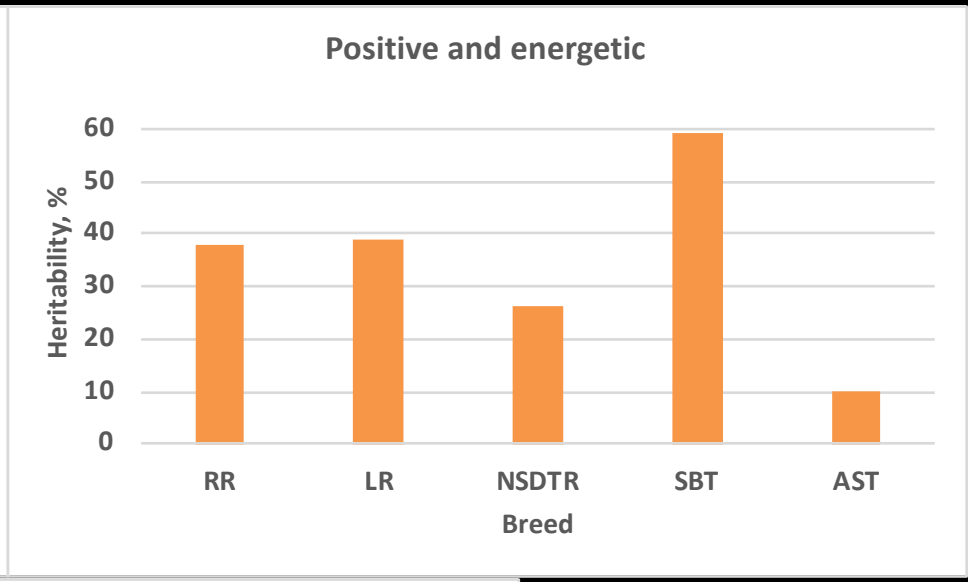


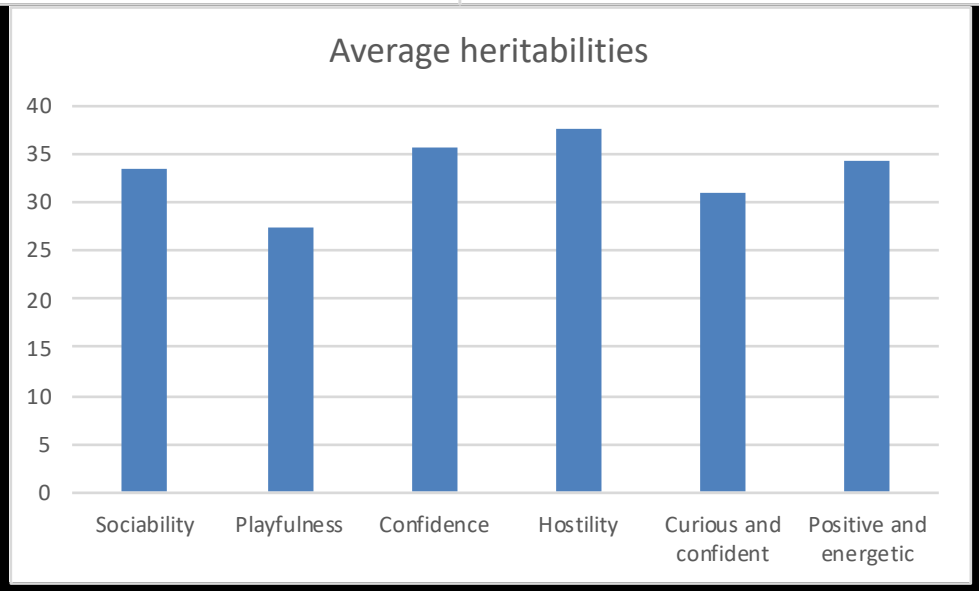




Heritabilities BPH







Genetic correlations BPH

- Generally, not yet enough data collected to estimate genetic correlations with reasonable accuracy, here example from breed with most observations, Ridgeback

	Confidence	Sociability	Hostility	Curious/Conf	Positive/Energetic
Playfulness	0.32	0.36	-0.07	0.36	**0.69**
Confidence	-	0.30	-0.16	**0.84**	0.43
Sociability		-	-0.19	0.38	**0.74**
Hostility			-	-0.12	-0.17
Curious/Conf				-	0.55

- Playfulness, Confidence and Sociability positively correlated
- These three positively correlated to C/C and P/E
  - Confidence strongest correlation with C/C
  - Playfulness and Sociability strongest correlation with P/E
- Hostility weakly negatively correlated to all other traits

Conclusions heritabilities and correlations

- In general, heritabilities for Sociability, Playfulness, and Curiosity from DMA and most traits from BPH high enough to make genetic progress possible (ca 0.25-0.35)
- More problematic for Chase-proneness, Aggressiveness, and Gun-shyness from DMA (0.1)
- Positive genetic correlations among Sociability, Playfulness, Chase and Curiosity/Confidence.
- Negative correlations between these traits and Gun-avoidance
- Aggressiveness/Hostility mostly unrelated to all other traits (or slightly negatively correlated)

Response to selection depends on:

Higher if higher heritability and more information

Higher if fewer (but still the best) animals selected

$$\frac{\text{Accuracy} \times \text{selection intensity}}{\text{Generation interval}}$$

Shorter time between generations is favorable

Accuracy for dogs with own result (at least) BPH

Based on heritability and only own result

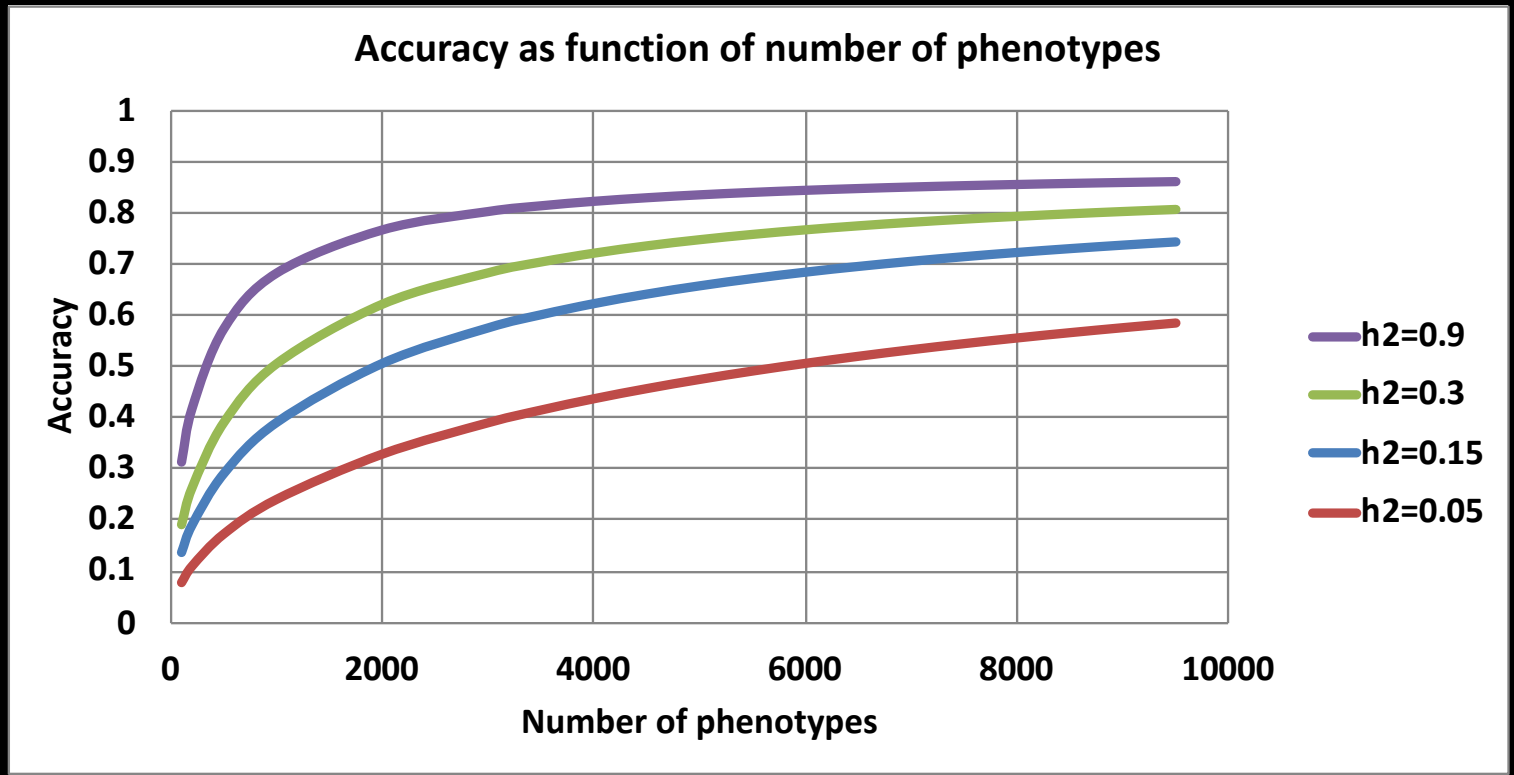
From BLUP genetic evaluation

Trait	Accuracy, rTI	
	Expected	Actual
Playfulness	0.55	0.64
Confidence	0.65	0.71
Sociability	0.52	0.61
Hostility	0.43	0.53
Curious and confident	0.60	0.67
Positive and energetic	0.59	0.66

Example from Ridgeback

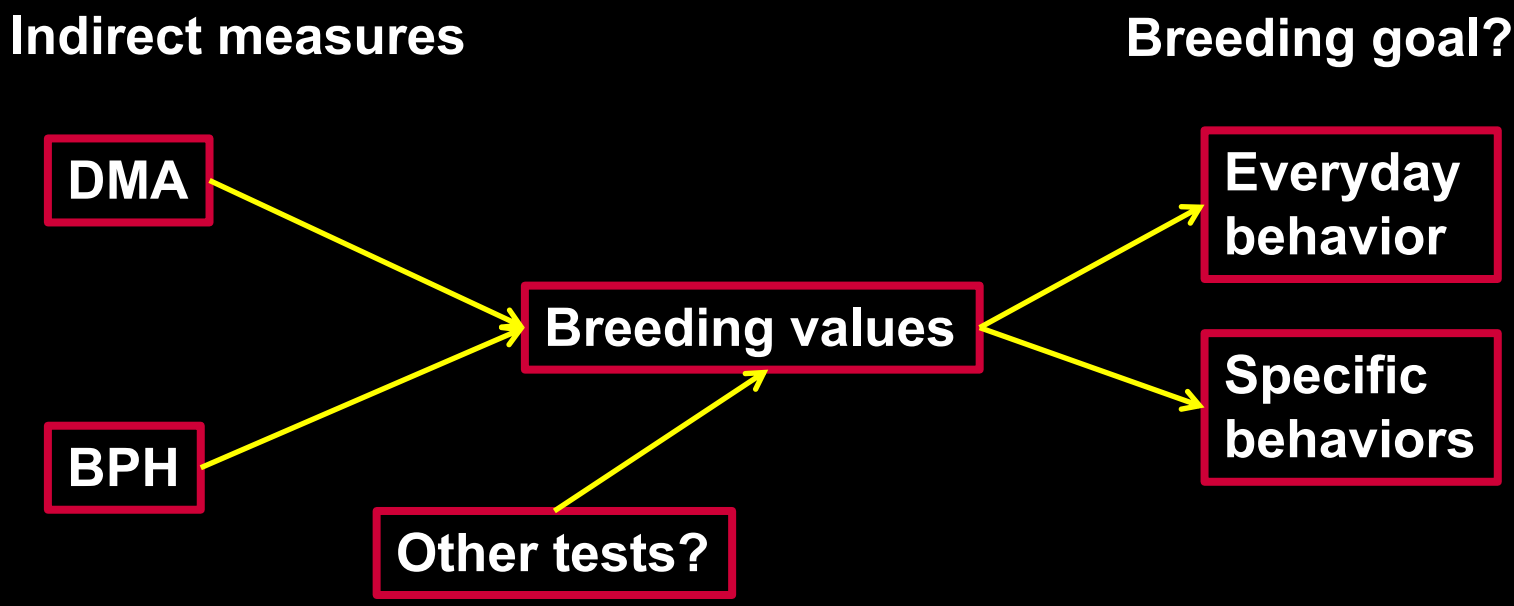
Genomic breeding values, GEBVs

- You can calculate a genomic breeding value at a very early age (as soon as you can take a blood or other sample)
- However, before you can get accurate GEBVs you need a large ”training” population of dogs with both phenotypes and genotypes



What to select for?

- For diseases, simple: select for less disease.
- For mentality more difficult
- Less fearful dogs – yes
- More curious/confident – a limit?
- Less aggressive – a limit?




SLU
SCIENCE AND EDUCATION FOR SUSTAINABLE LIFE