Session 25.

Application of social effects in a pig breeding program

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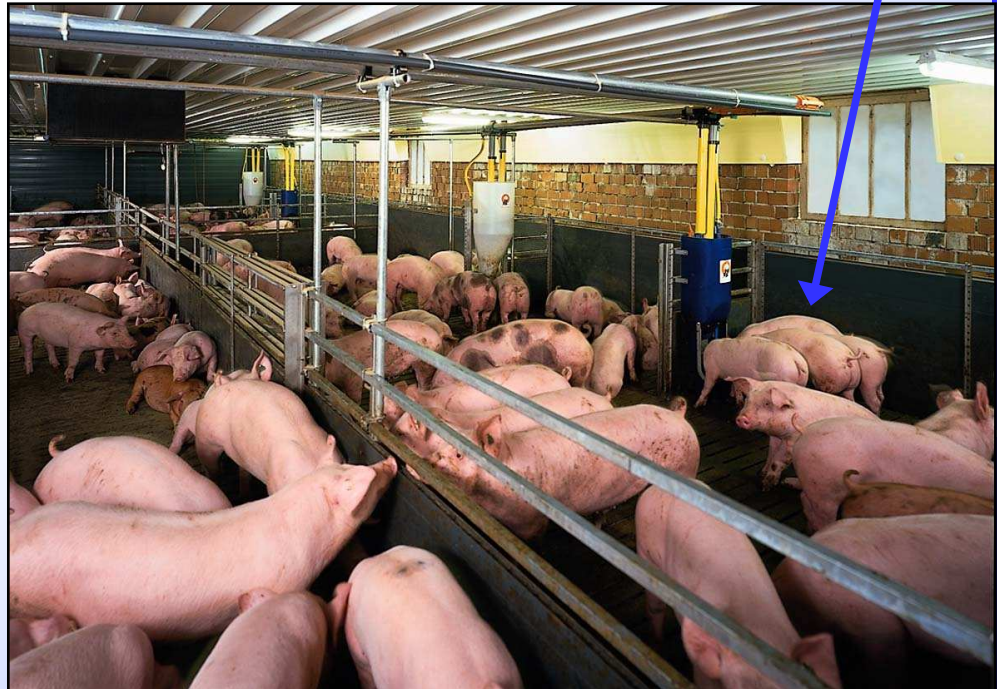# Social interactions in pigs

Animals (especially family members) are willing to help each other in a group to keep the genes of the family. *(Hamilton, 1964)*
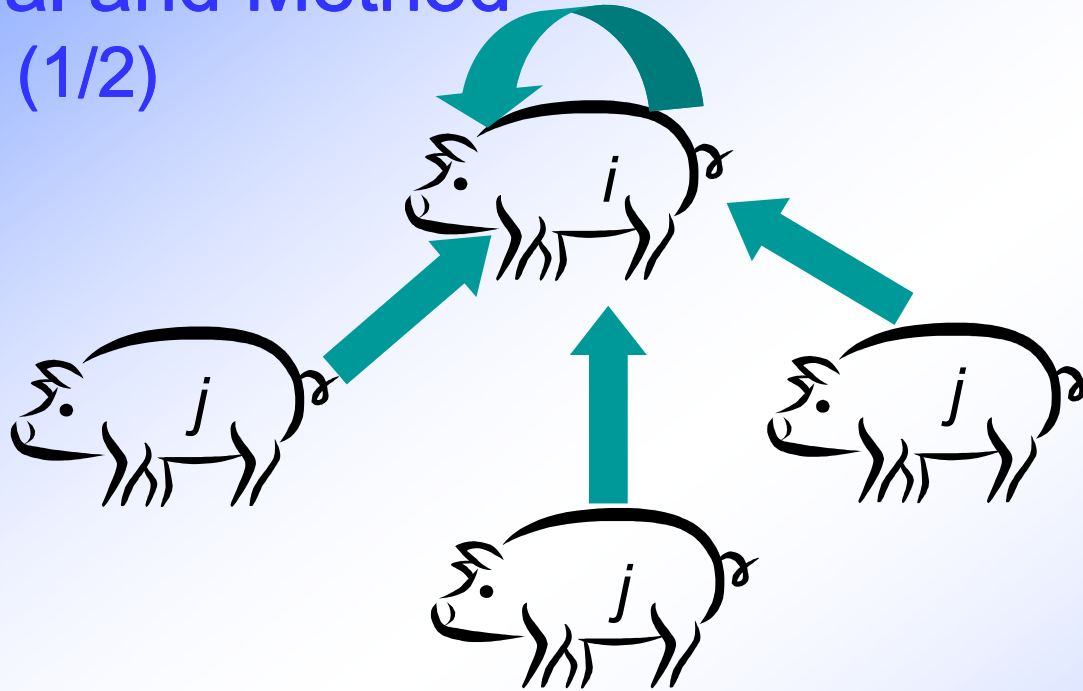
Introduction

- Reduced genetic response and animal well-being

- Competition or cooperation for limited resources

   Such as feed intake

Material and Method
Theory (1/2)

Inheritance model for traits affected by social interactions
(Griffing 1967):

$$P_i = A_{D,i} + E_{D,i} + \sum_{i \neq j}^{n} A_{S,j} + \sum_{i \neq j}^{n} E_{S,j}$$

Material and method
Theory (2/2)

- Response to selection

Social interactions

$$\Delta G = iR_{IH} \boxed{\sigma_A} \longrightarrow TBV_i = A_{D,i} + (n-1)A_{S,i}$$

i is the selection intensity, R_{IH} is the accuracy of selection.

Parameters used

Trait: Growth rate

Average group size: 8.5

Selection intensity: 1.627

Table 1. Parameters for a relatedness of 0.18 (Bergsma *et al.,* 2008).

|	Classical analyses	Social interactions included
Phenotypic variance	7023	7324
Direct genetic variance	1780	1522
Associative genetic variance	-	51
DA genetic covariance	-	56
Heritable variation	0.25	0.71
r_A	-	0.20

r_A = Genetic correlation between direct and associative effect
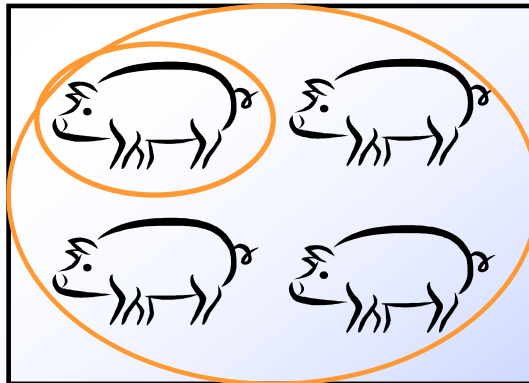
Material and method
Selection methods

- ## Multilevel selection $\quad C_i = P_i + g\sum_{j\neq i}^{n} P_j$
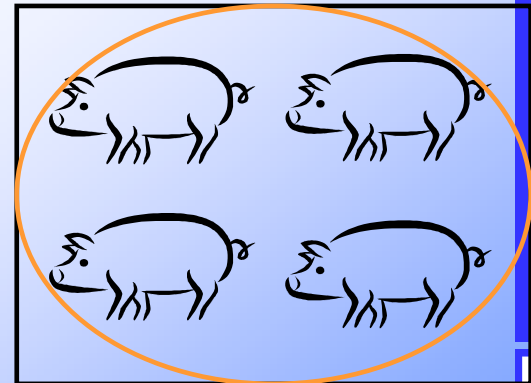
Individual
selection (g=0)
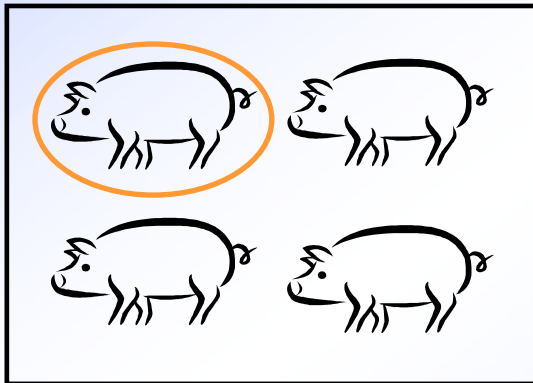
Selection in
between

Group selection
(g=1)

Material and method
Selection methods

- ## BLUP simulation

    – Uses information from full sibs, half sibs and parents

    – Selection on TBV

    – 1 generation: 100 replicates

    – Estimates random effects and fixed effects

$$y = Xb + Za_D + Za_S + e$$

Results
Mass selection

Selection response:

'Classical'	$\Delta G = 1.627 * \sqrt{0.25} * 42 = 34$ g/d
Social interactions incl.	$\Delta G = 46$ g/d

ratio ≈ 1.35
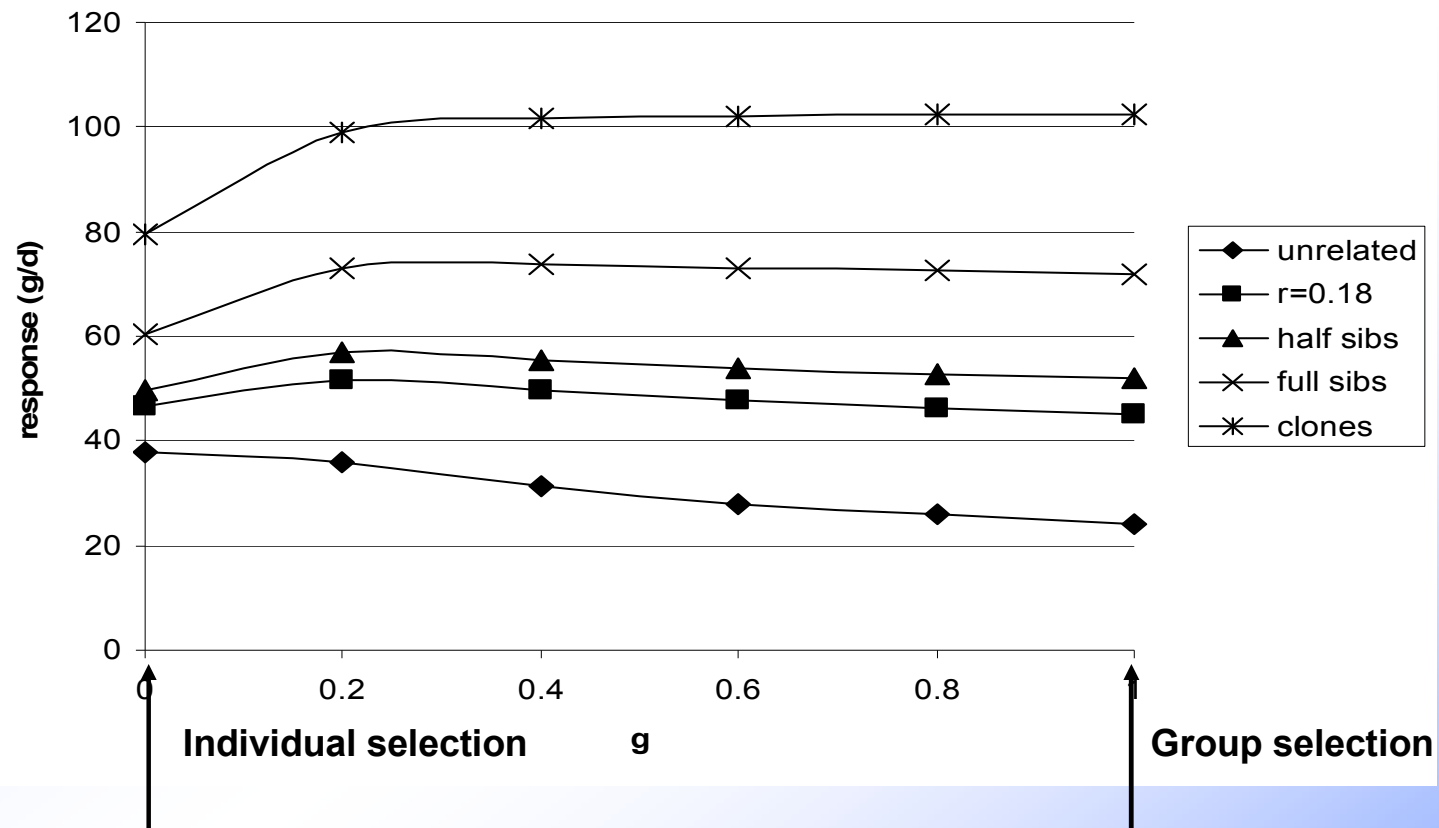
Accuracy

'Classical'	$r_{IH} = \sqrt{h^2} = \sqrt{0.25} = 0.50$
Social interactions incl.	$r_{IH} = 0.39$

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Results
Multilevel selection

Results BLUP

	Group composition	r_{IH}	ΔG (g/d)
BLUP	Unrelated (r=0)	0.50	59
BLUP	Full sibs (r=0.5)	0.79	93
BLUP_Classic		0.69	47

Ratio ≈ 2.0

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Conclusions

- BLUP would be the best selection method for feed intake in pigs
  - Accuracy of estimates of social effects increases with increased relatedness within groups (pens)
  - Takes fixed and random effects into account
  - More traits can be included

Are we breeding for social pigs??

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