Is milking order connected to social interactions?

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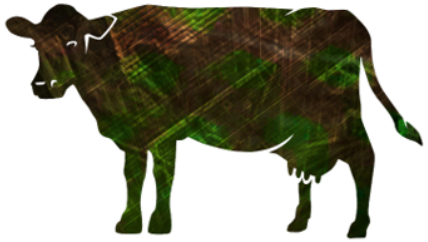


Aim

Investigate if milking order to a milking parlor is connected to the cow's social role in the herd, to increase our understanding of social behaviour

With a further aim to examine the relationship of social contacts and milk yield

- By using sensor data to create social networks and milking order data from a milking parlour

Previous research on milking order

- Variable results
- Fairly consistent milking order

- **High milk yield**
  (Rathore, 1982; Dias et al., 2019)
- **High dominance**
  (Rathore, 1982; Sauter-Louis et al., 2004)
- **Low somatic cell count**
  (Rathore, 1982; Berry & McCarthy, 2012)

More variable in the middle

- **Lame cows**
  (Sauter-Louis et al., 2004)

Milking Parlour

Social behaviour in dairy cattle

Social Interactions

Calming effect

Can cause stress

Affiliative Interactions
(Socio-positive)

- Allogrooming
- Spatial proximity

Agonistic Interactions
(Socio-negative)

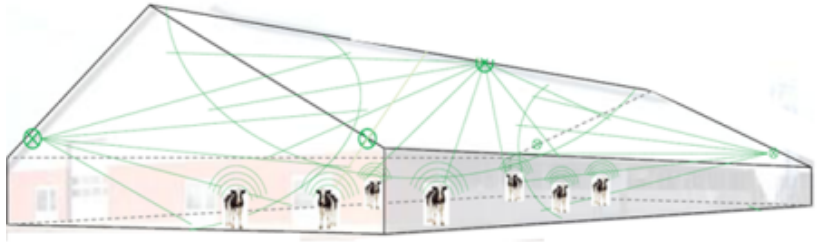
- Head Butt
- Fighting
- Replacement
- Avoidance

Bouissou et al., (2001); (Boissy et al., 2007)

Social behaviour in dairy cattle

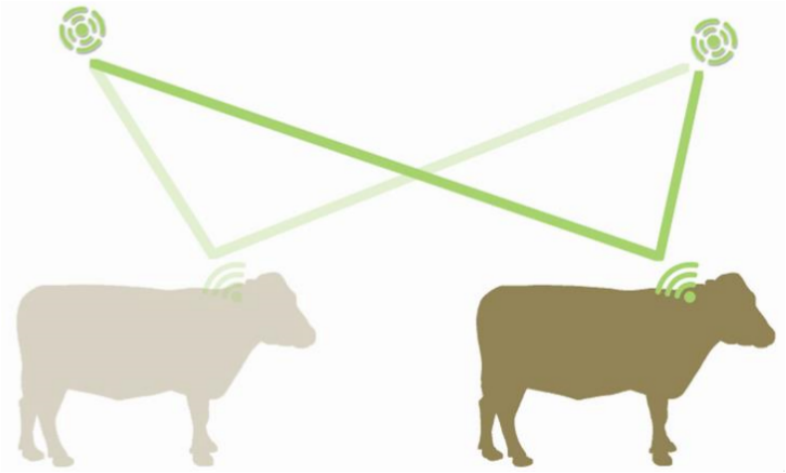
- Cows differ in their tendency to stay close to other individuals
- Preferential bonds with individuals with similar attributes
- Variation in social network in different areas of the barn

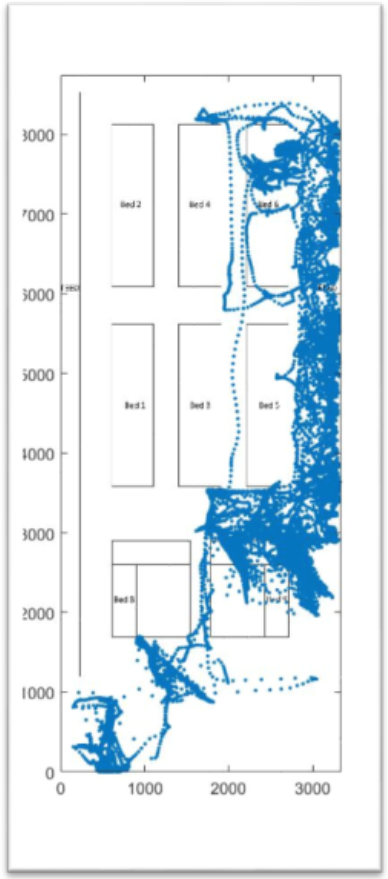
Boyland et al., (2015); Gygax et al., (2010); Rocha et al., (2020)



RTLS – Real Time Location System

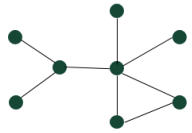
- GEA – CowView
- Ultra-wideband
- Position of a cow every second, 24/7
- Precision of ~ 78 cm

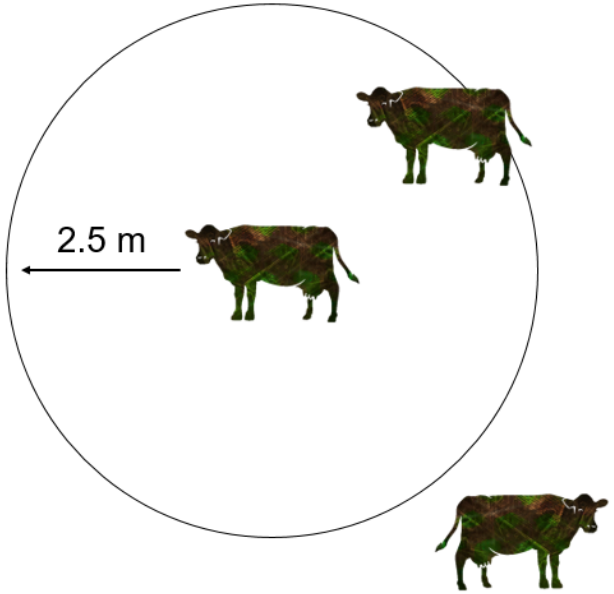




https://app.gea-cowview.com

Social network within the barn





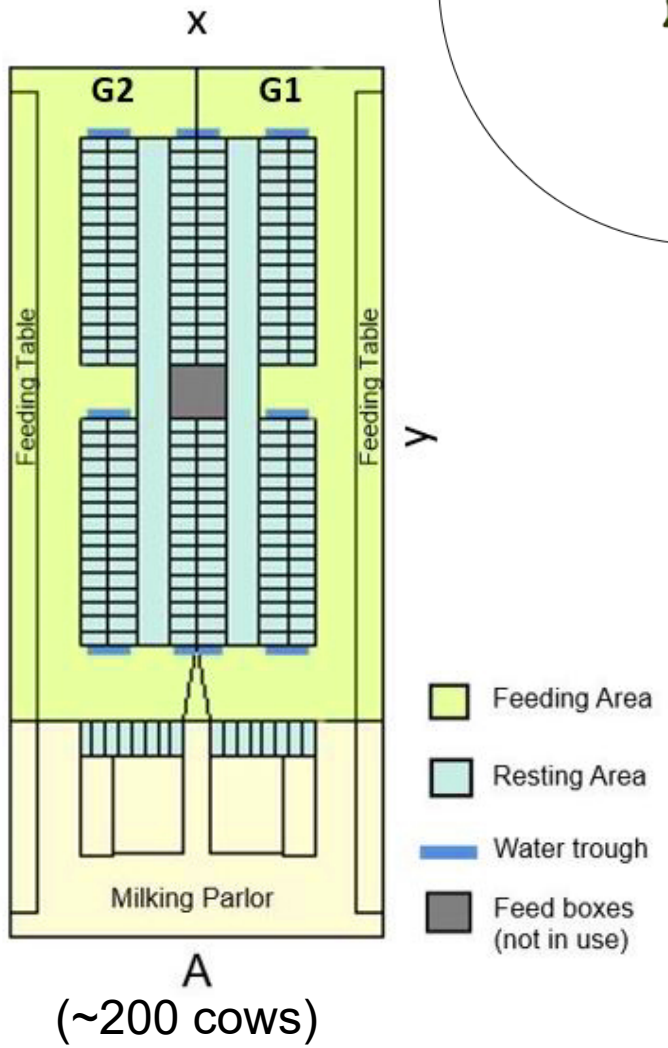
Definition of a contact:

- Distance radius: 2.5 m
- >10 min per day

The total duration of contacts $t_{contact,i,k}$ for each cow *i* and day *k* (14 days)

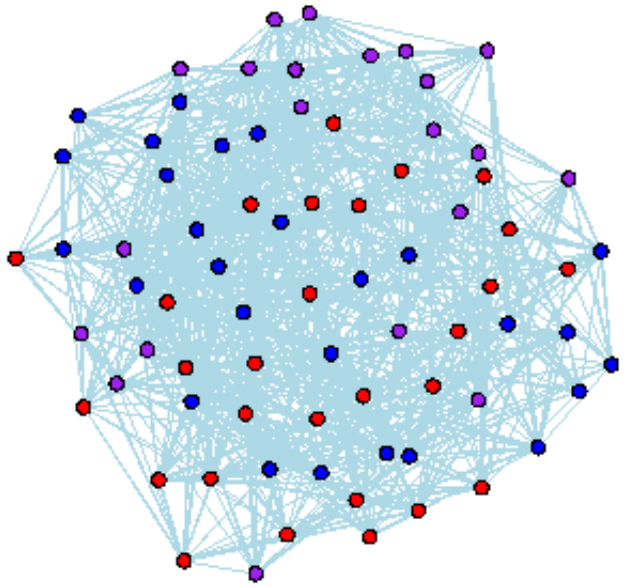
Feeding and Resting Area

2 Groups



(~200 cows)

Social network analysis



t=0-1

Adjacency matrices

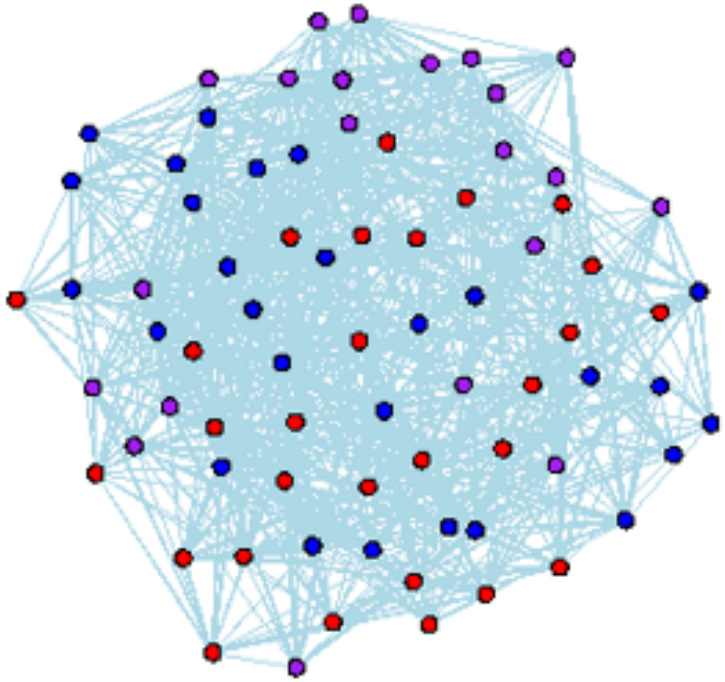
Social networks constructed with
- nodes representing individual cows

- the (spatial) interactions between any two cows were represented as the presence (1) or absence (0) of an edge linking the nodes

Topological network parameters

Valuable insights into the social roles of dairy cows within the herd

- Degree
- Betweenness centrality
- Closeness centrality
- Eigenvector centrality scores

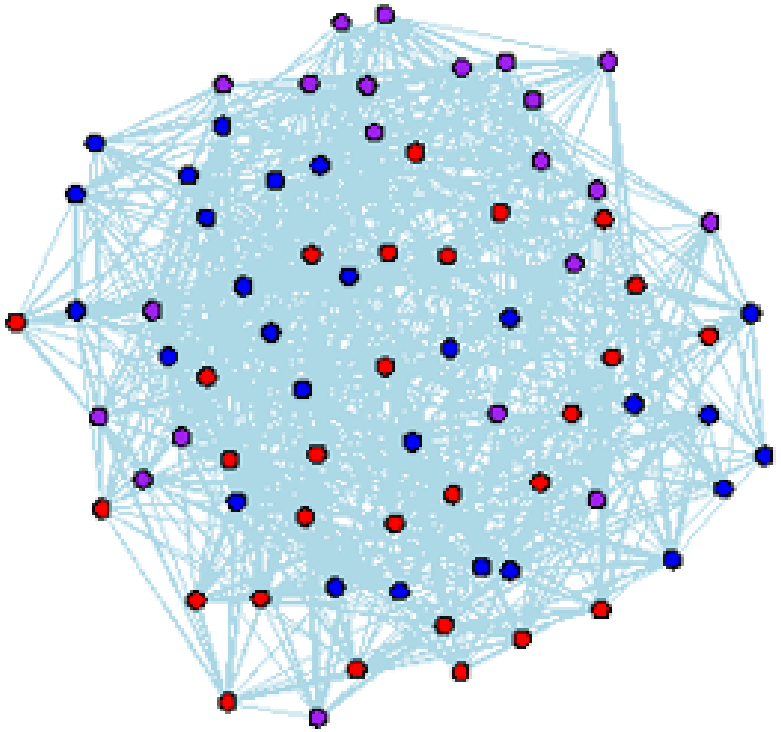


Topological network parameters

Degree

- the total number of interactions (edges) related to a particular node

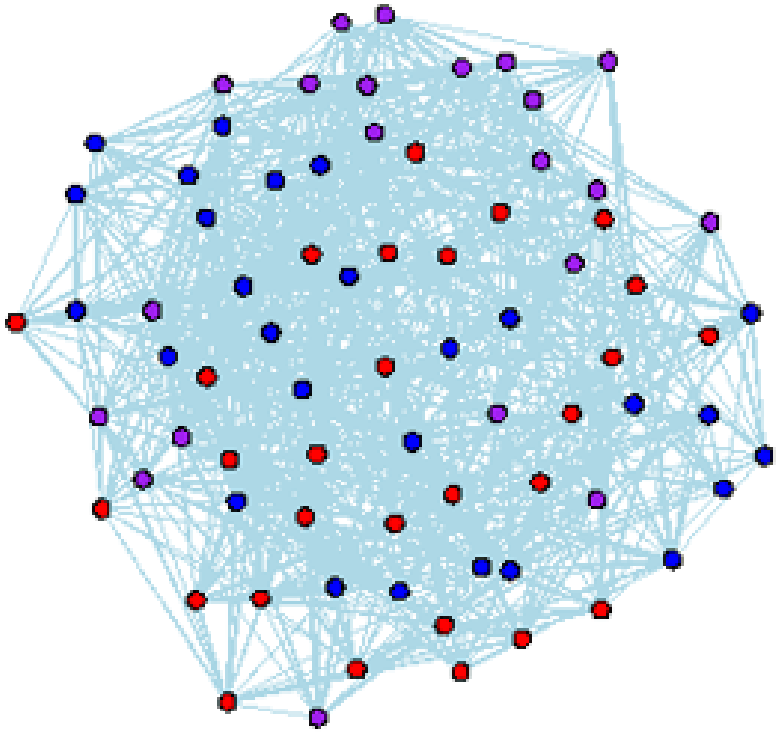
- simplest measure of node connectivity



Topological network parameters

Betweenness centrality

- the number of shortest paths between two nodes that pass through a specific node, with respect to the total number of shortest paths



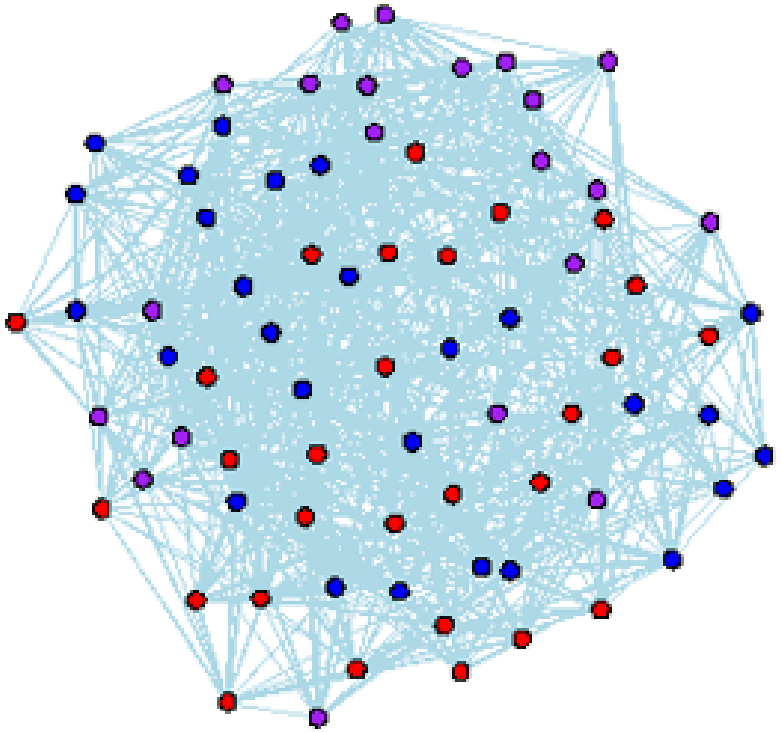
- reflects the contribution of an individual node to the network's connectivity

Topological network parameters

Closeness centrality

- estimates the average shortest path length of a node

- represents how closely connected a particular node is to the rest of the nodes of the network

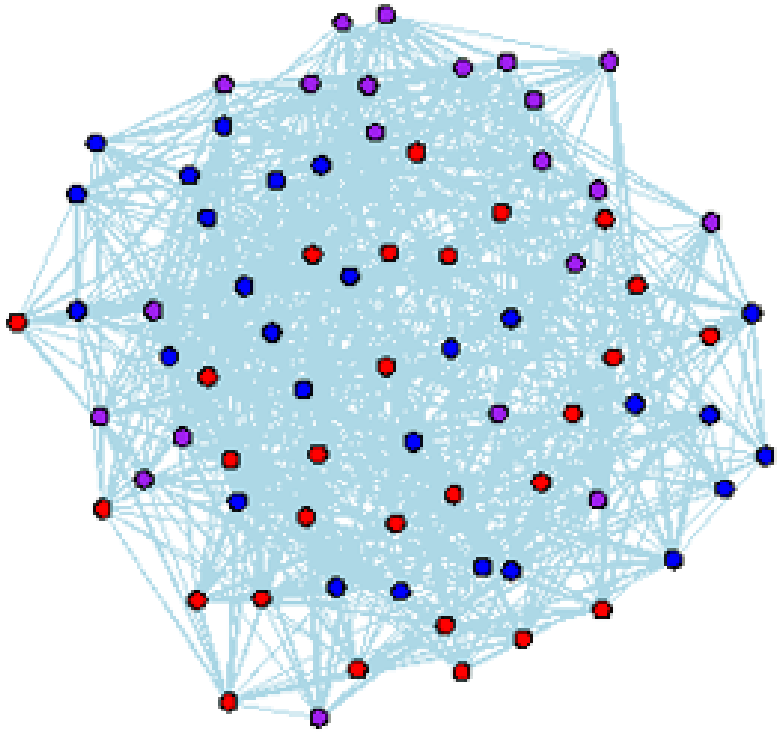


Topological network parameters

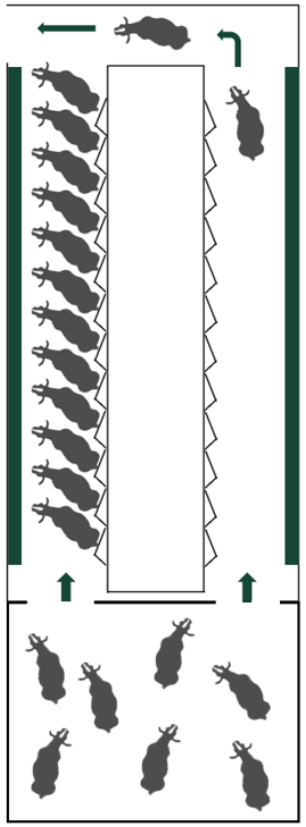
Eigenvector centrality scores

- summarizes in a unique value
the number of interactions and their quality

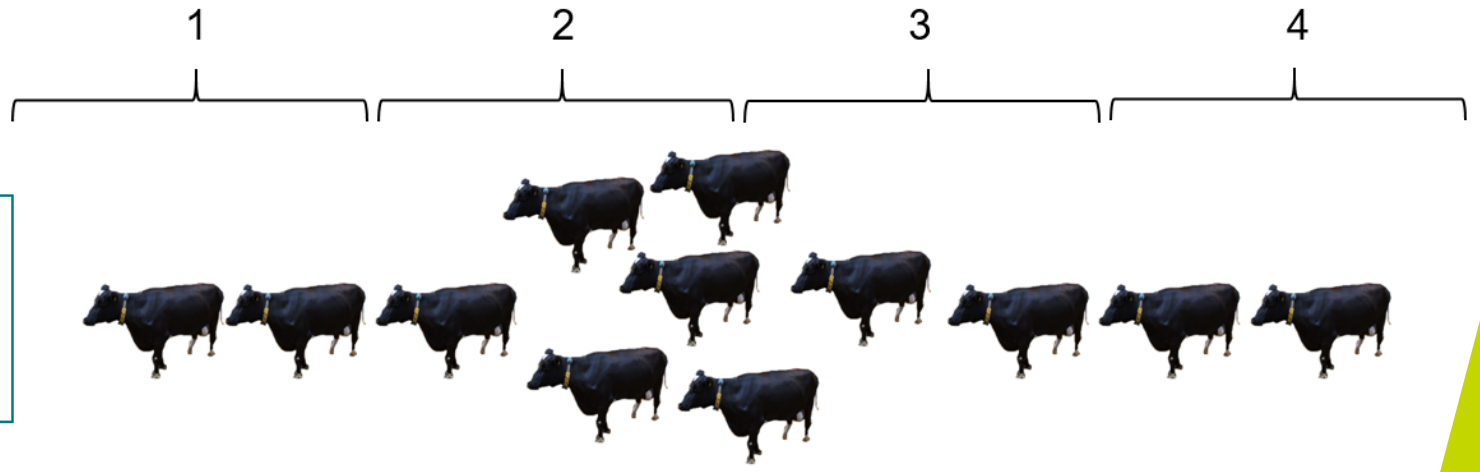
- high values indicate that a particular node
is connected to several nodes which
themselves have high scores



Is milking order connected to the cow's social role in the herd?



- Position and timestamp data from the milking equipment
- 4 Milking order groups (First, Second, Third, Last)
- Ordinal logistic regression



Results

- Repeatability of the network parameters ranged between 0.21 – 0.42
- Higher in the resting area

Repeatability	G1 (Early lactation)		G2 (Late lactation)	
	Feeding	Resting	Feeding	Resting
Betweenness	0.31	0.25	0.26	0.33
Closeness	0.24	0.37	0.21	0.39
Degree	0.24	0.38	0.23	0.40
Eigenvector	0.34	0.41	0.33	0.42

Results

- No effects of the network parameters in the feeding area
- Positive associations between all network parameters in **the resting area** and entering the parlor **early**

Betweenness
Closeness
Degree
Eigenvector

↑

Betweenness
Closeness
Degree
Eigenvector

↓

Milking Parlour

Conclusions and discussion

- The social role is more consistent in the resting area

- Cows that contribute more to the network's connectivity, are more closely connected to the rest of the individuals, and have more contacts in the resting area

  → have higher odds of enter the milking parlor early

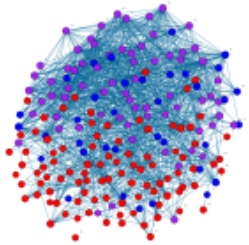
- Related to where they choose to rest?
- Cows more “comfortable” with crowded areas? More social?

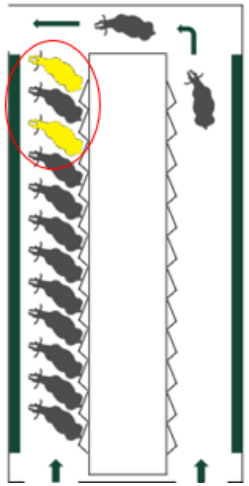
Why is this important?

- Increase our understanding of the social behaviour in dairy cattle
- Animal welfare – which cows spend more time in the waiting area?
- Can changes in milking order indicate abnormal behaviour?
- Further studies on milk yield

Is milk production connected to social contacts?

Do your neighbours have an effect on your milk yield?





Further studies

Do your neighbours have an effect on your milk yield?

Applications:

- Important how the cows are grouped and that cows can walk freely into the milking parlour (not pushing)
- To further understand the social interactions between cows for further work on estimating indirect genetic effects in dairy cattle

Acknowledges

Thank you for listening!

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