Sociability in grazing dairy cows is related to individual social network properties and behavioural synchrony

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Introduction

Sociability

- The motivation of individuals to be close to conspecifics
- Animals show individual differences – underlying trait
- 'Gold standard': Social Runway Test

Latency to make contact with conspecifics

Introduction

- In dairy cows kept indoors, sociability – measured in a social runway test – is related to the behaviour at group level[1]
  - High latencies ⇨ behaviour less synchronised
  - High latencies ⇨ less close to other cows

Key parameter:

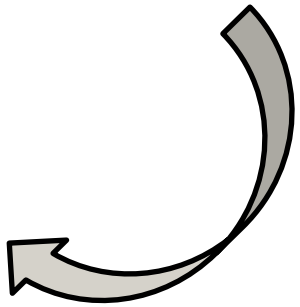
Distance to nearest neighbour

[1]Gibbons et al., 2010. Appl Anim Behav Sci 122, 84-91.

Research questions

- Is the response to a social runway test performed **outdoors** consistent?
- Is the response to a social runway test performed **outdoors** associated with behavioural synchrony?
- Is the response to a social runway test performed outdoors associated with distance to nearest neighbour **on pasture**?

and other social network properties of the individual?

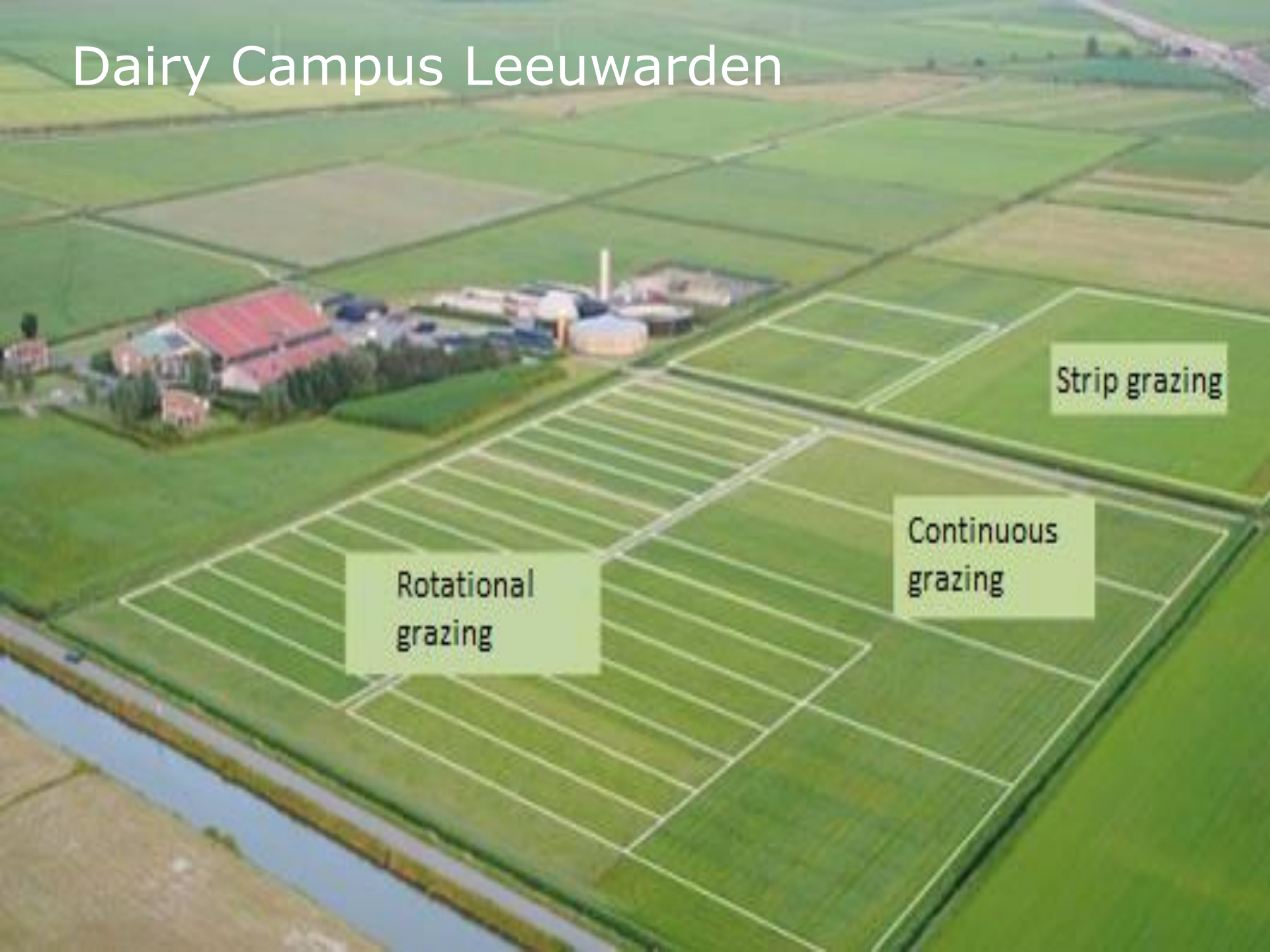


Materials and methods

Experiment

- Grazing experiment
- Comparison of three grazing systems
- 20 cows per system – 60 cows in total

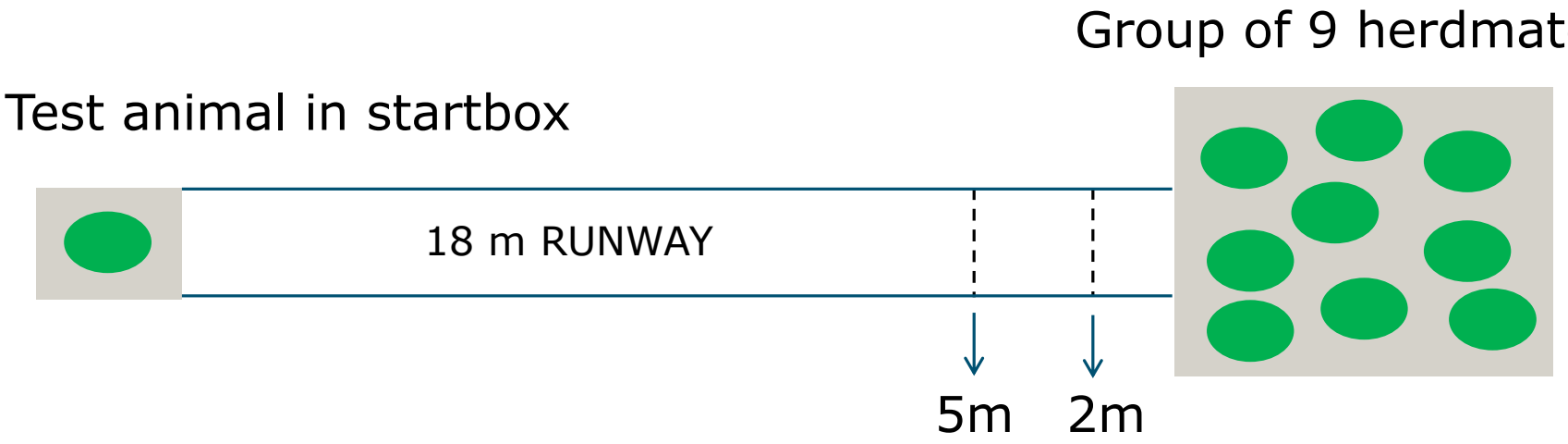
Dairy Campus Leeuwarden



Materials and methods

Social runway test

- Performed twice in each cow, 8 weeks in-between tests
- Performed on cow path (concrete) from pasture to barn
- Latencies to reach 5m or 2m from group mates
- Max duration 300 sec



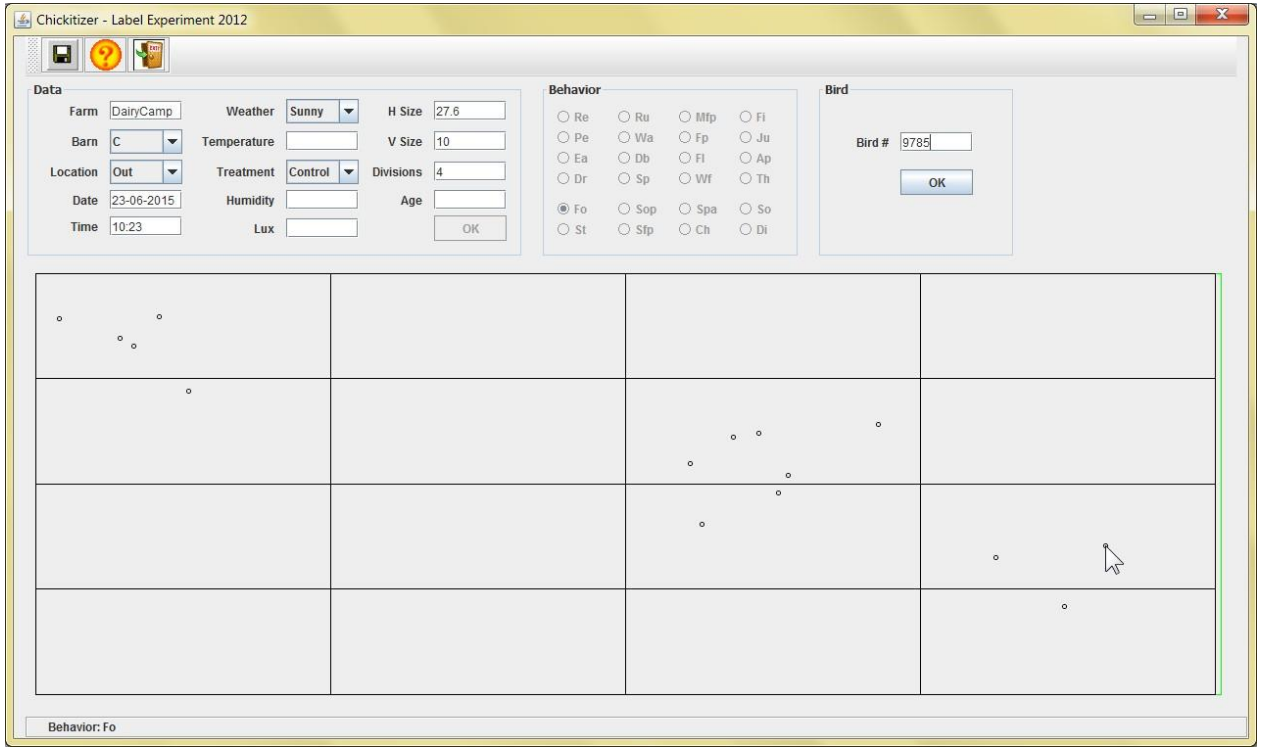
Materials and methods

Social runway test

Materials and methods

Location data

- XY coordinates recorded during 105 visual scans in each group over a 14-day period (*Chickitizer software*)



Materials and methods

Location data

- Transformation of location data into proximity data

Proportion of scans that cows make 'contact' ≤ 2m

Association matrix

Matrix 2m	724	918	921	1040	1131	1143	1146	1153	1178
918	1.96								
921	4.95	4.00							
1040	1.00	0.00	1.03						
1131	0.99	3.00	4.04	1.03					
1143	1.00	1.00	2.04	8.33	3.06				
1146	1.94	0.00	1.00	2.02	4.00	2.02			
1153	1.92	6.80	2.94	1.00	3.92	4.95	4.85		
1178	4.85	0.00	7.92	0.00	4.95	5.00	3.92	5.77	
1202	1.96	0.99	0.99	3.06	2.00	2.02	0.99	3.88	0.00

Materials and methods

Social network properties

- Social network analysis with UCINET and SOCPROG software

- Calculation of individual network properties = connectivity metrics
  - Strength = index of sum of associations of an individual with all other individuals (~ distance to nearest neighbour)
  - Eigenvector centrality (EC) = measure of how well an individual is connected to other well-connected individuals

Materials and methods

Sensor data

- 24 hours/day, 7 days/week

Standing/lying

'IceQube'

Materials and methods

Synchrony of standing/lying from sensor data

Time on pasture divided in scans: 15 min inter-scan interval

For each scan determine:

- Is herd synchronous , i.e. ≥ 60% are doing the same
- Is individual cow synchronous with the herd
- Individual measure of synchrony

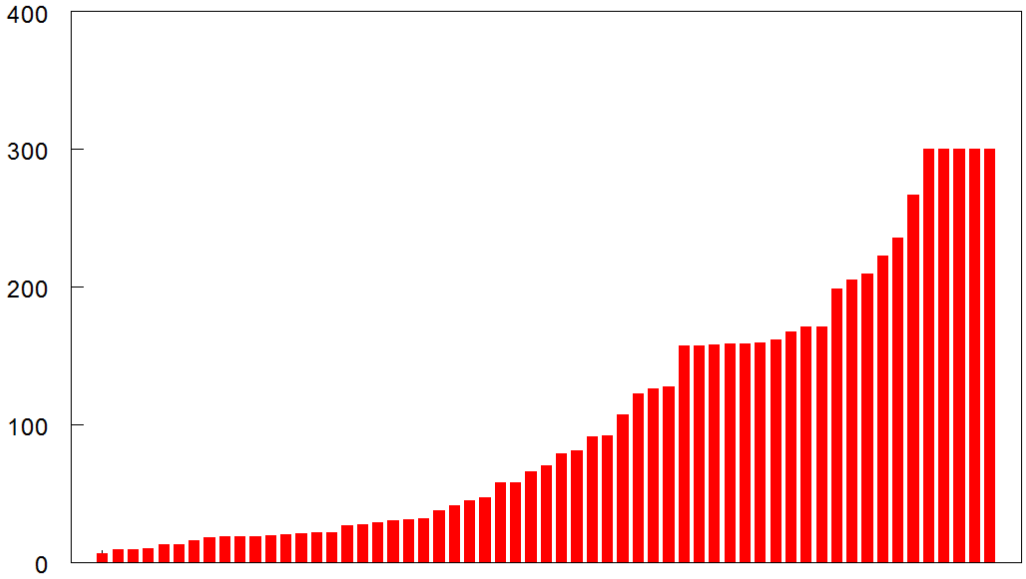
#scans synchronous with herd / # scans herd is synchronous* 100%

Results

Response to social runway test

Large variation in response between individuals

Average latency to reach 2m (sec)

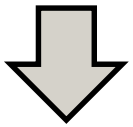


Results

Repeatability of response to social runway test

Repeatability = $\sigma^2_{cow} / (\sigma^2_{cow} + \sigma^2_{error})$

- Latency to 5m: 0.48 ($P < 0.01$)
- Latency to 2m: 0.30 ($P < 0.01$)



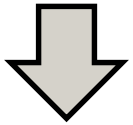
- Average latencies used in analysis of covariance

Results

Consistency of behavioural synchrony

Average synchrony per month (May – October)

- All correlations between averages per month are significant (Rspearman 0.30 – 0.74, N=60), $P < 0.05$)



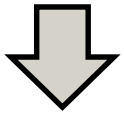
- Average level of synchrony averaged over 6-month grazing season was used in analysis of covariance

Results

Relationship between social runway test and individual social network properties & behavioural synchrony

Analysis of covariance

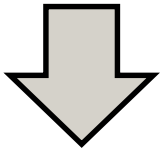
- Latencies to 2 and 5 m negatively associated with Strength, Eigenvector centrality, and behavioural synchrony



- Regression coefficient (β): similar for grazing systems

Conclusions

- Individual differences in response to social runway test and behavioural synchrony are consistent over time
- Short latencies in the social runway test corresponded to close proximity, high connectedness to herd mates, and high behavioural synchrony



- Sociability is a stable personality trait in grazing dairy cows that influences behavioural dynamics at group level

Thank you for your attention!

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