Social Network Analysis and management of calves and dairy cows

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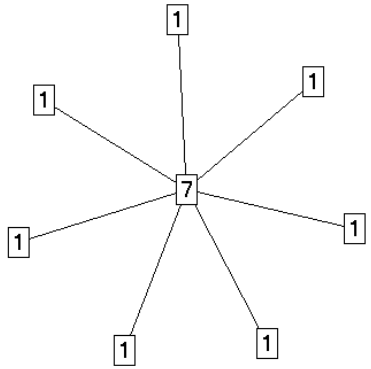
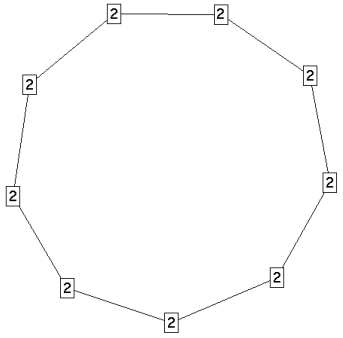
The social behaviour of cattle

- Large, highly organised groups with stable social relationships (Bouissou and Boissy, 2005)
  - dominance-subordination relationships
  - preferential relationships

Introduction

- Social networks in animal species may indicate social stress and social support that are important for welfare.
- A recent finding shows that “Calves seem to form preferential relationships before 3.5 months of age. Keeping cattle together from an early age seems beneficial for them”. (Raussi, et al., 2010)
- Degree is the number of connecting lines, and the actor with the most lines is the most important.
- Closeness: the more central a node is the lower its total distance from all other nodes.

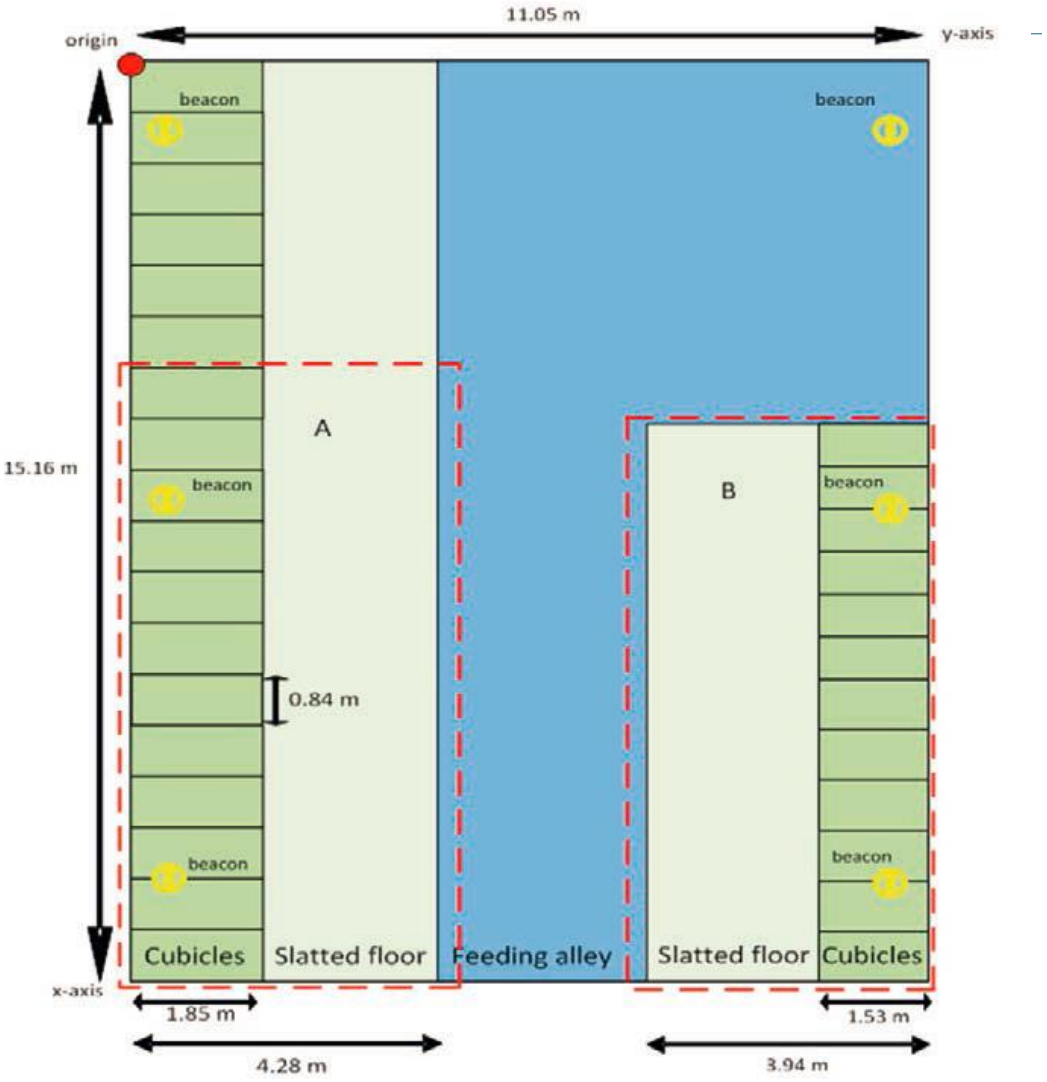




Material & methods

- We tried to confirm this statement using a Social Network approach and a group of 10 Holstein-Friesian calves (6 males/4 females) aged 3 to 4 months.
- Individual automated location registration (X-Y position) was used to calculate the nearest neighbour of each calf in the pen (4 x 11 meters).
- Data were analysed per day excluding the dark period (21-06 hrs.), when calf activity was low.
- To challenge the calves and their relationships the feeding regime was changed from dried alfalfa (day 1-6) to wet silage (day 7-12).

Proof of Principle



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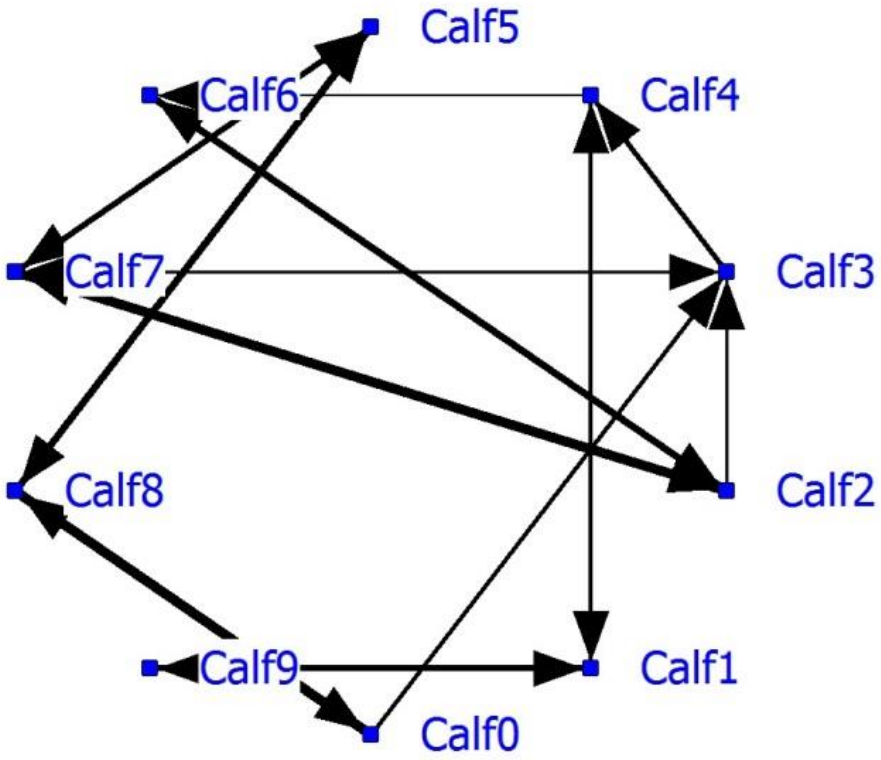
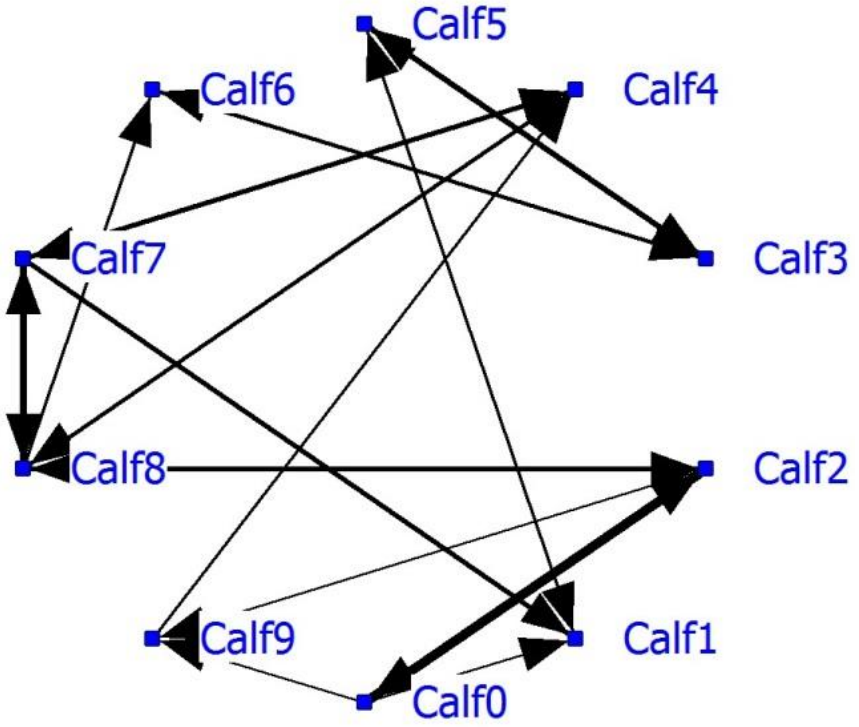
SNA-interpretation of nearest neighbor

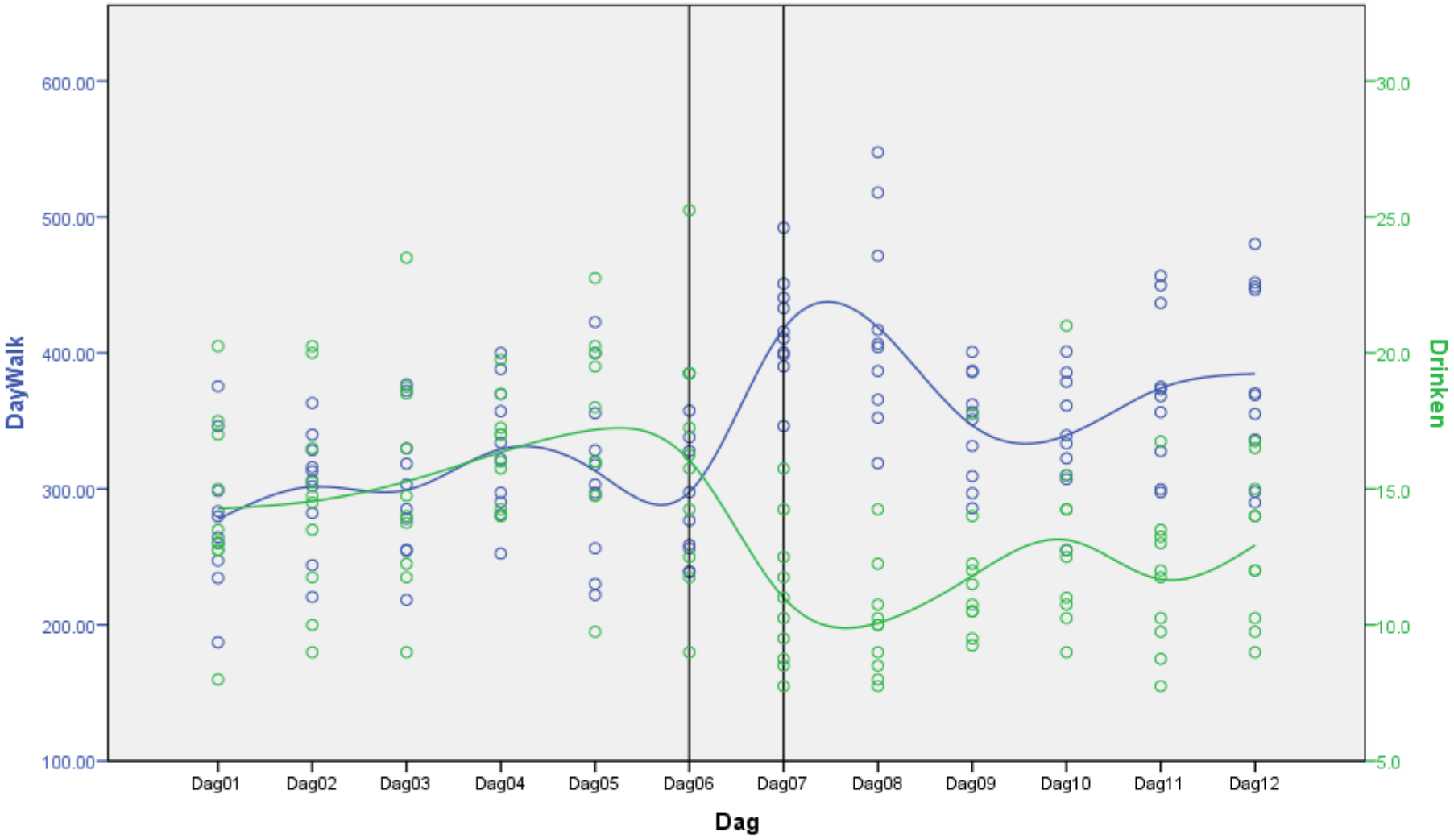
Standardized Residuals (SR)	>1.96	<−1.96
Social Network	Positive	Negative
Preference/valence	Affection	Aversion
Motivation	Approach/seek	Avoidance/escape
Social behavior	Socio-positive (support?)	Socio-negative (stress?)
Individual welfare	Positive?	Negative?

Social Network (positive and negative)

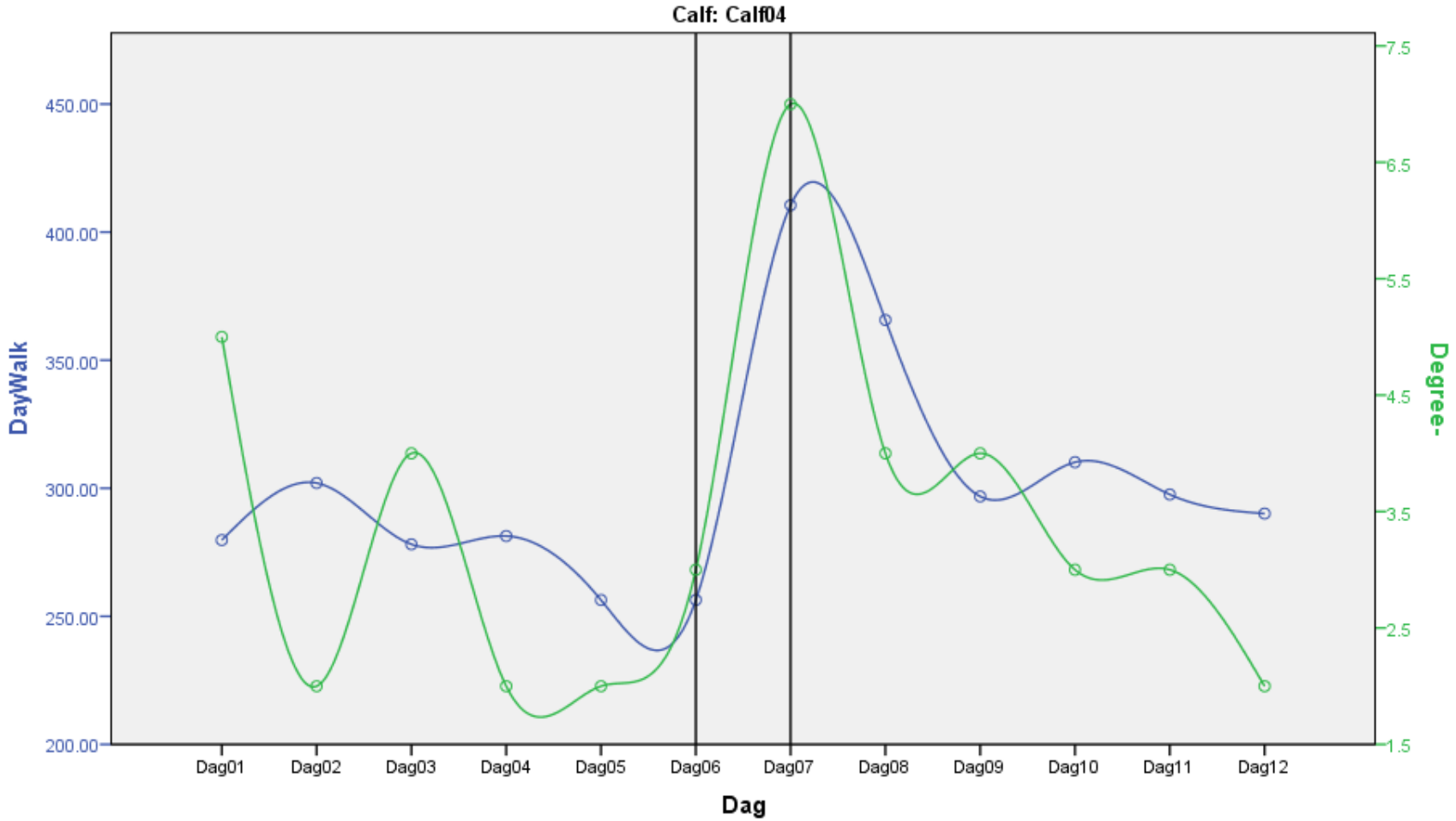




Change in feed between day 6 and 7

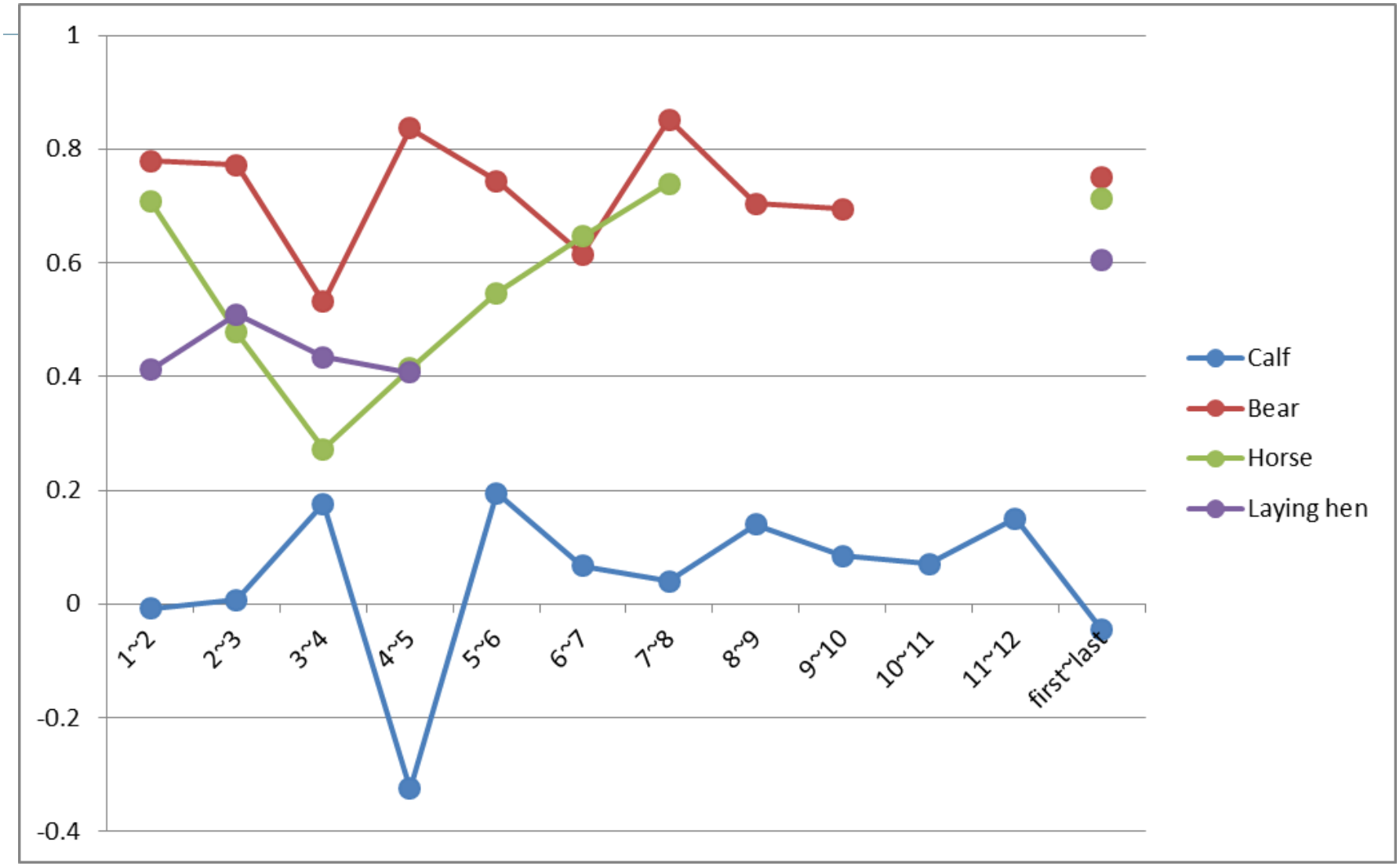


Activity and #degrees -

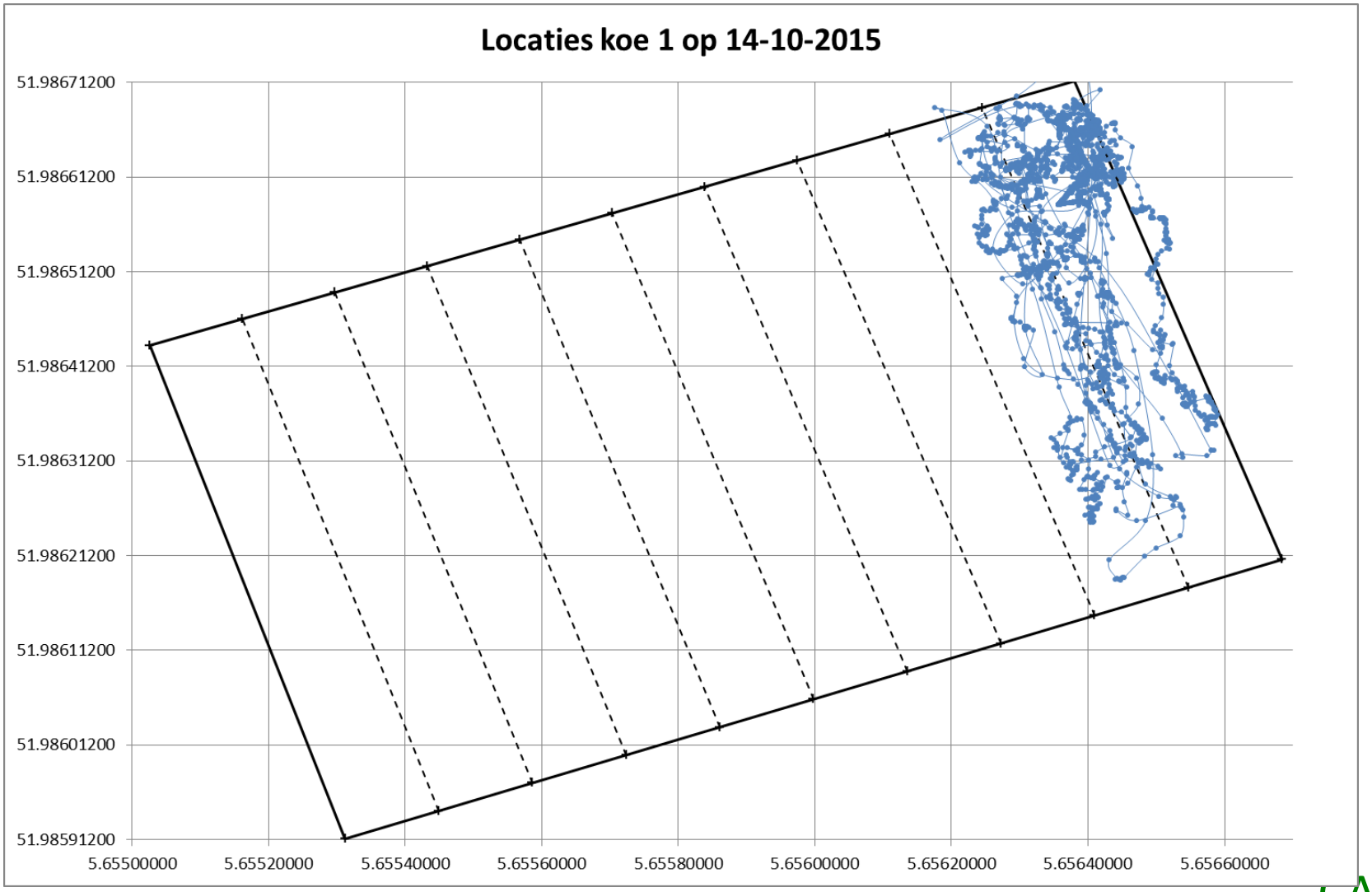


Closeness in the positive network decreased (P=0.041) while closeness in the negative network increased (P=0.003)

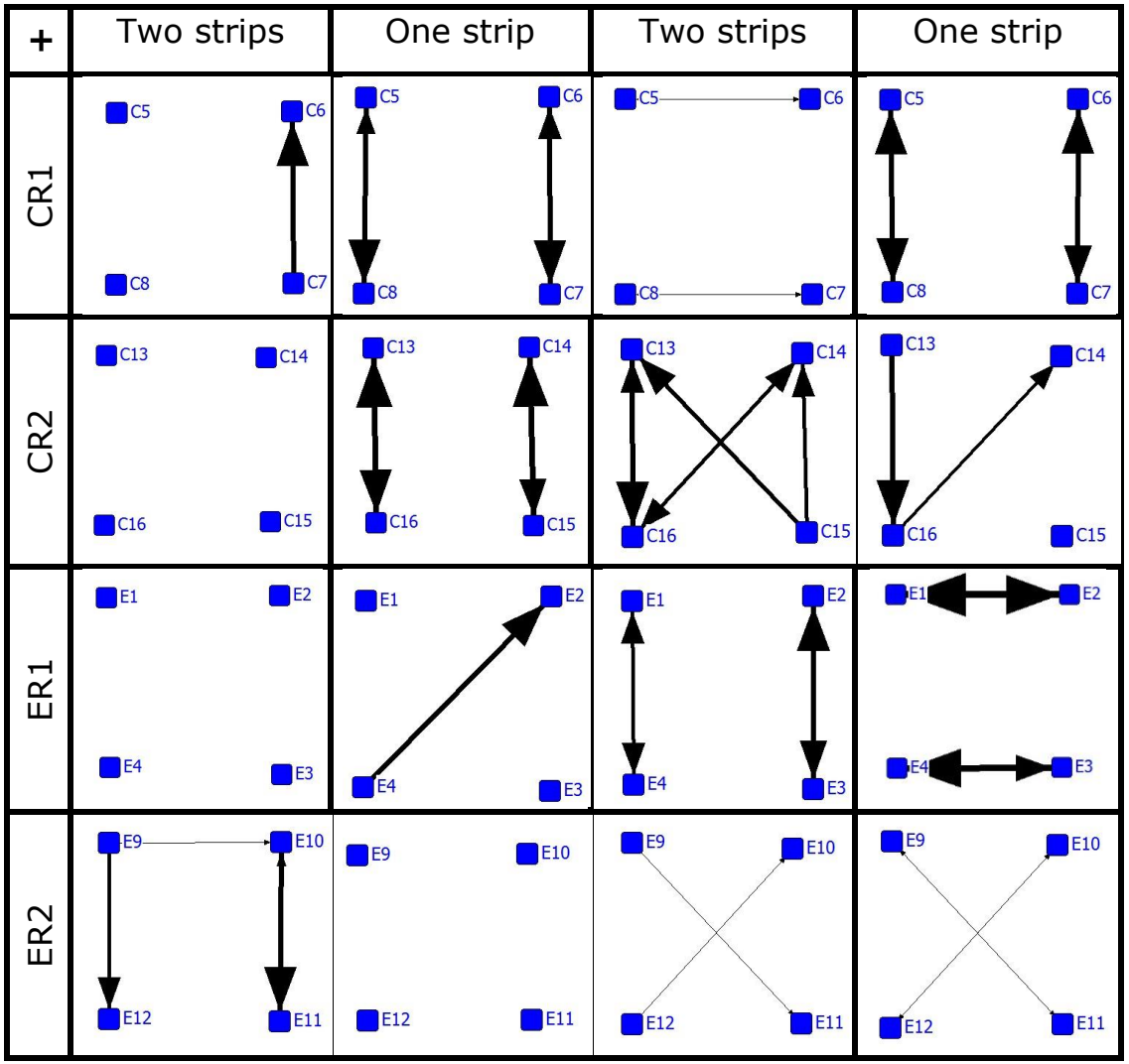
Network stability of calves (correlations)



Groups of 4 heifers (GPS)



Associations during grazing



Influence of social networks on welfare and productivity in dairy cattle (Boyland 2015)

- ***Conclusion Dairy cows***

The network was highly centralised and **social stability was low**, however there were heterogeneous relationships between cows and we found evidence for assortment by traits. Social network position was linked to the health and productivity of cows; more gregarious individuals had higher milk yields and higher somatic cell counts which may represent a cost-benefit trade-off.

- ***Conclusion calves***

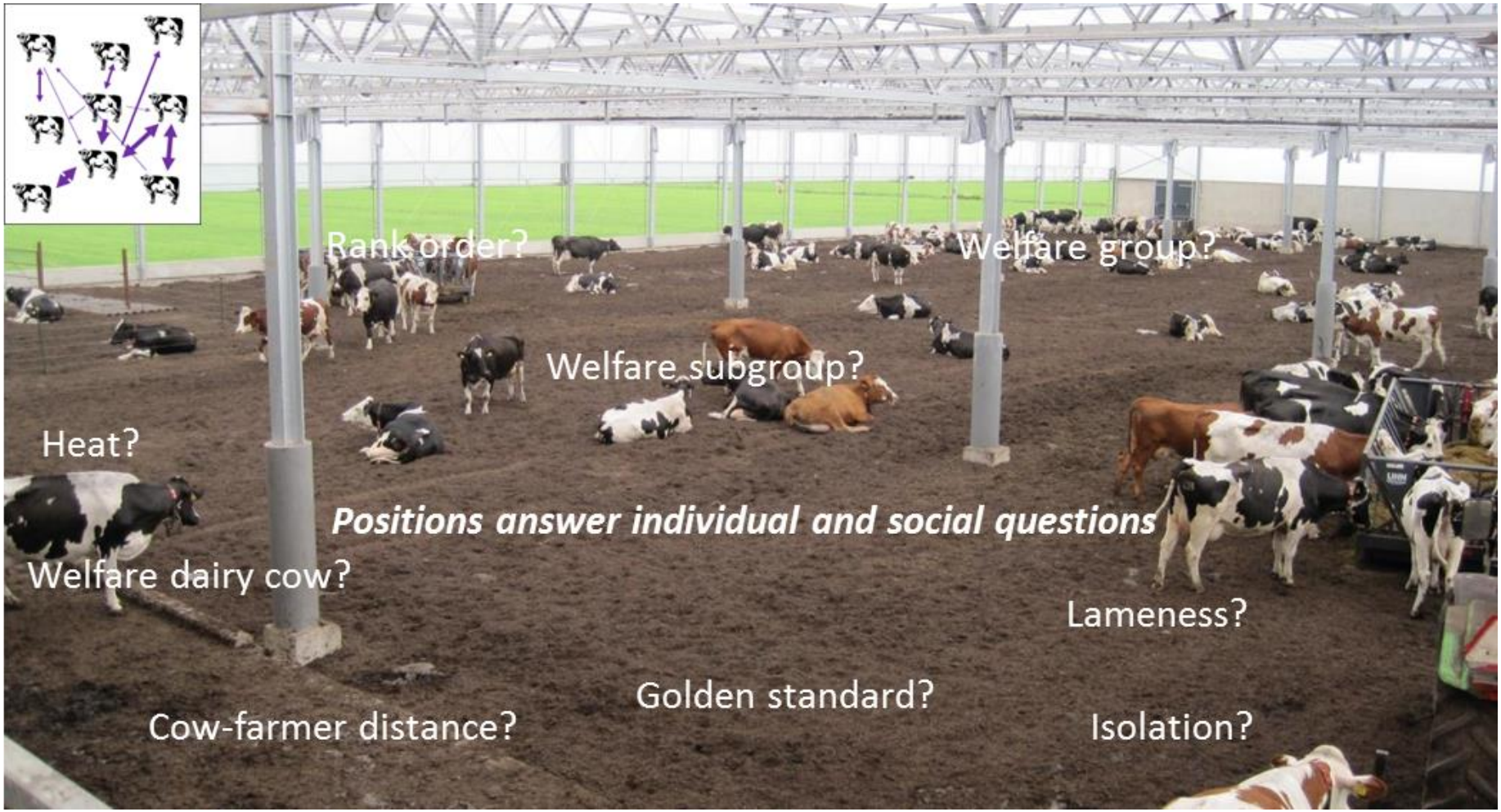
The social networks of calves when grouped together **showed some stability** and relationships were heterogeneous, with social associations being influenced by prior familiarity.

Conclusion?

- "Calves seem to form preferential relationships before 3.5 months of age."
- Calves
  - Social stability low or absent?
- Heifers
  - Social stability low and changes daily?
- Dairy cows
  - Social stability low?

- "Keeping cattle together from an early age seems beneficial for them". ?????????

The Challenge? Social Stability?



Thanks

Next year WAFL 2017 (Welfare Assessment at Farm of group Level), Wageningen

- Special session on Social Networks and Welfare
- Keynote Jens Krause
- Questions?

Summary

- Social parameters: social support, social stress.
- Linking social parameters to keeping/production
- Automatic recording of locations and follow-up management actions are feasible (indoor, outdoor).
- Individual management possible using X,Y-position and
    - Individual position (t1→ t2): locomotion
        - Lameness, estrus, disease
    - Neighbor position (social network parameters)
        - associations, interactions (feed, robot)
    - Facility position (milking, feeding, drinking, rest)
        - facility usage and social influence
- Searching social stability to support cow management!

The social behaviour of cattle

- Large, highly organised groups with stable social relationships
  - dominance-subordination relationships
  - preferential relationships
- Bouissou M.-F., Boissy A. 2005
  - The **preferential relationships** essentially developed between calves during ontogeny, are responsible for the **cohesion** of the group and help to attenuate social tensions.