



Network analysis of the group structure of horses on pasture using GPS data

**Frederik Hildebrandt, Kathrin Büttner, Jennifer Salau,
Joachim Krieter & Irena Czycholl**

Institute of Animal Breeding and Husbandry, Christian-Albrechts-University, 24098 Kiel, Germany
fhildebrandt@tierzucht.uni-kiel.de

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Introduction

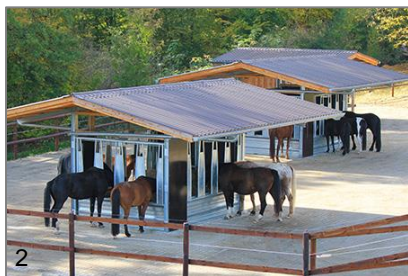


Natural
habitat



- Process of group formation of horses presently not adequately investigated
- Anonymous subgroups?
(Goldschmidt-Rothschild, 1978)
- Influence of newcomers and departures of horses

Wilderness:
10 to 20 horses
per herd
(Waring, 2003)



Private
keeping/
pension
stable





Aim of the study

Investigation of the contact structure and the group formation with the help of the **network analysis**





Material & Methods

Data recording

- In total 53 horses in the study
- Open stable system (HIT-Aktivstall) in Northern Germany
- GPS-Sensors (QSTARZ BT-Q1000XT) taped on nylon collars
 - Sampling frequency: 0.1 Hz
- 9 month data collection
 - June 2018 – February 2019
- Exemplary analysis of morning pasture time (60 minutes) with the help of network analysis of 30 days in October 2018

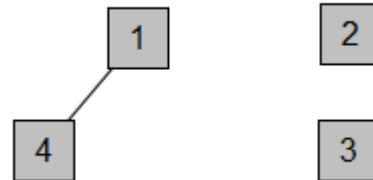
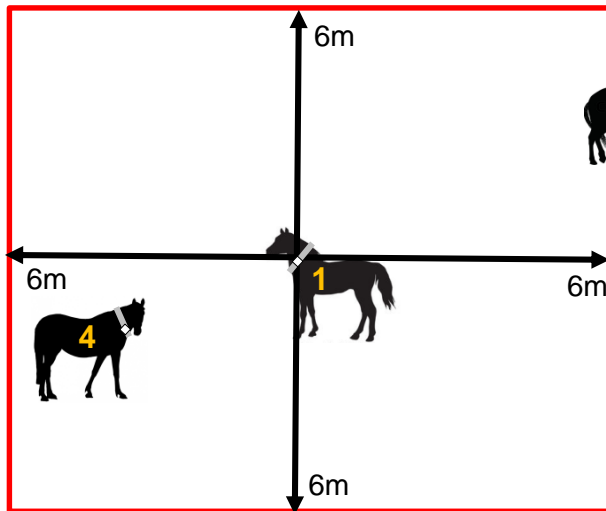




Material & Methods

Network

- **Nodes** (→ Horses) and **edges** (→ Contact between horses)
- Definition horse contact
→ Two horses have contact if closer then **6 meters** in any coordinate



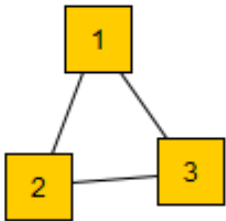


Material & Methods

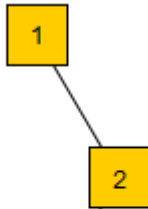
Density

→ Amount of **actual edges** against all **possible edges**

→ From **0** (no edges) to **1** (all possible edges present)



Density = 1



Density = 0.33



Density = 0

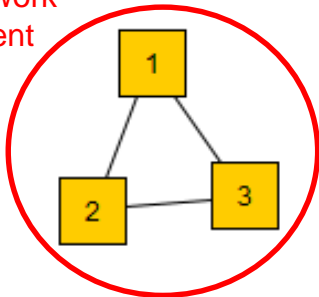


Material & Methods

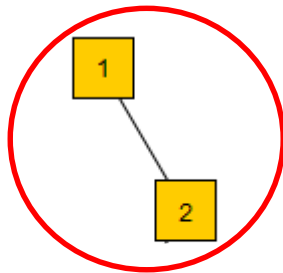
Fragmentation

- Amount of **network components** in relation to all nodes
 - Network component: Two nodes → Same component → Connected by at least one path through the network
- Between **0** (entire network connected, one network component) and **1** (no edges, only isolated nodes)

One network component



Fragmentation = 0



Two network components

Fragmentation = 0.67

Three network components



Fragmentation = 1



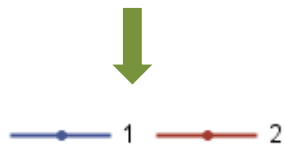
Material & Methods

Observation period (60 minutes)

- 10-minutes intervals \rightarrow 6 different networks



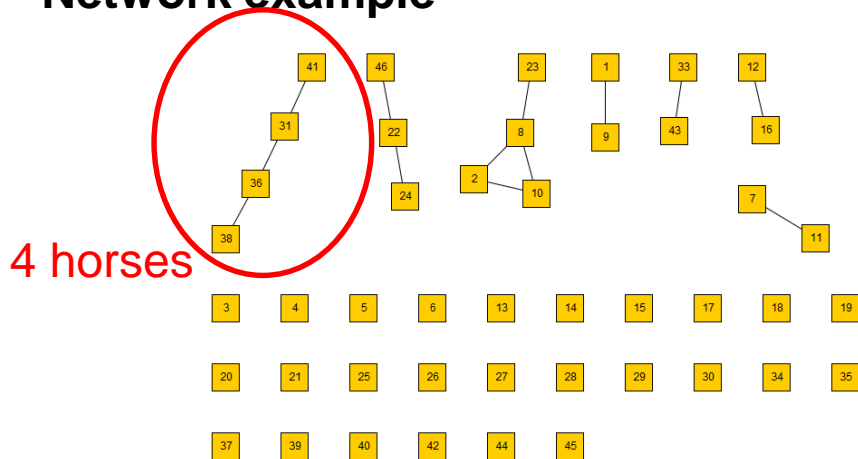
- 30-minutes intervals \rightarrow 2 different networks



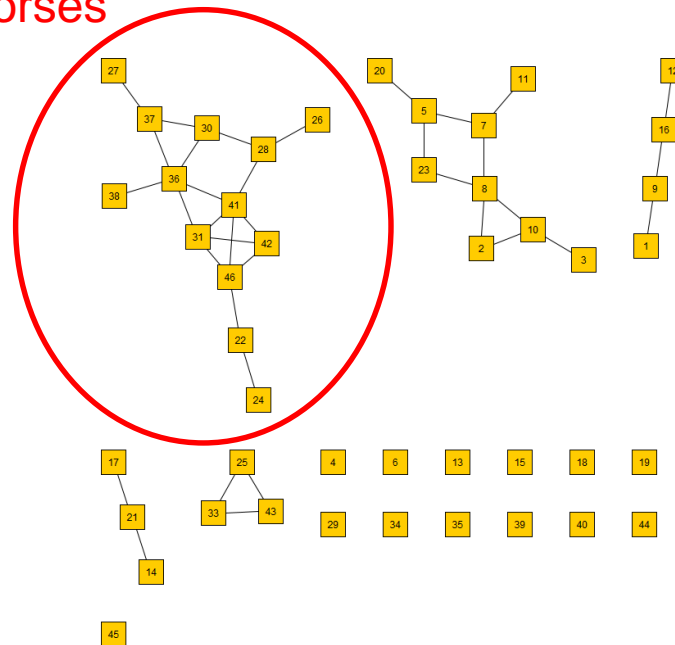


Results & Discussion

Network example



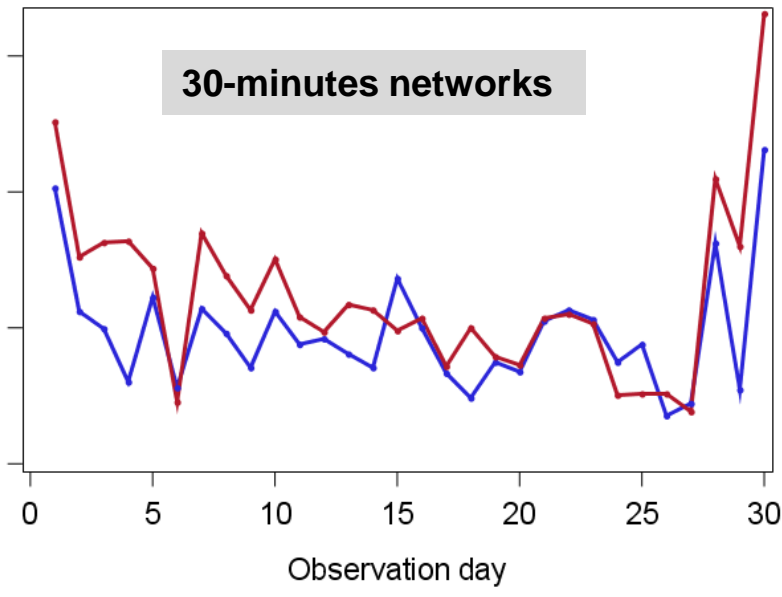
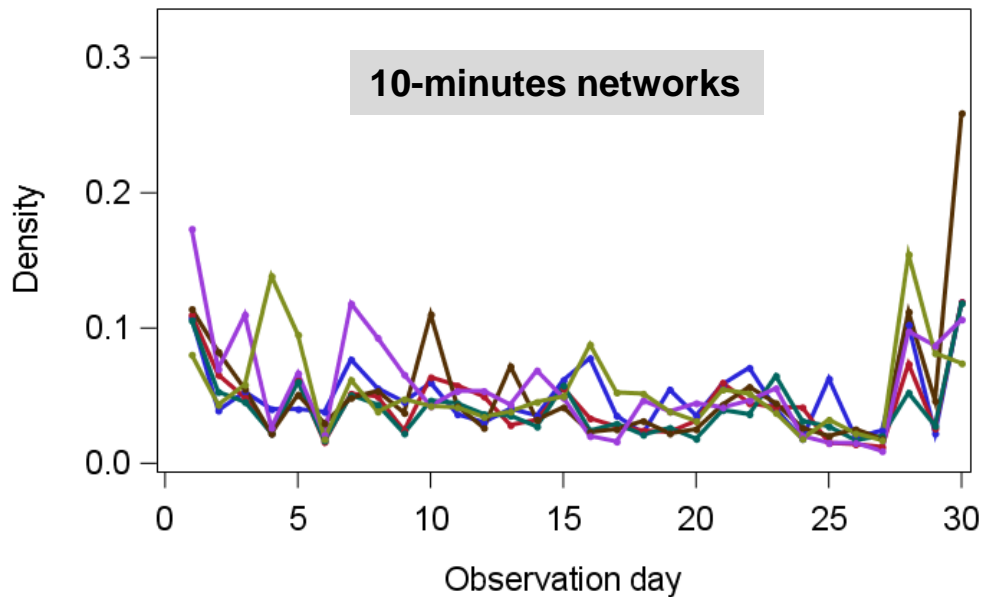
13 horses





Results & Discussion

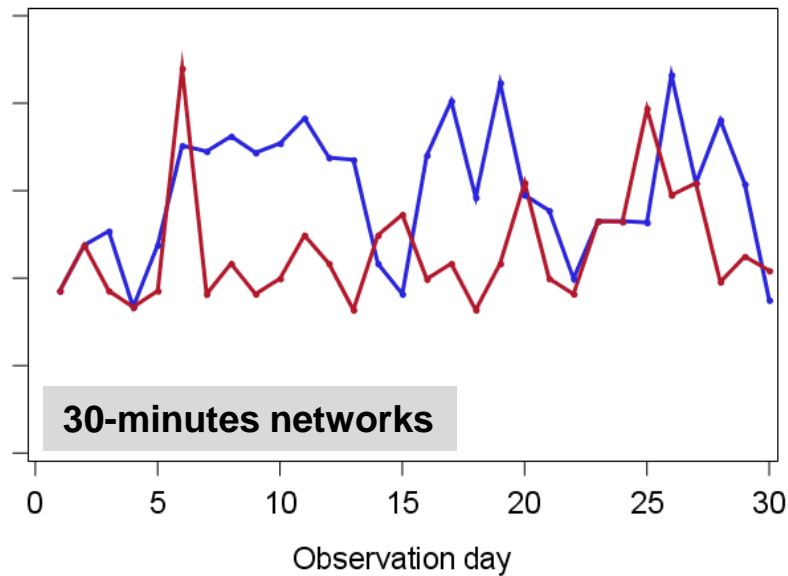
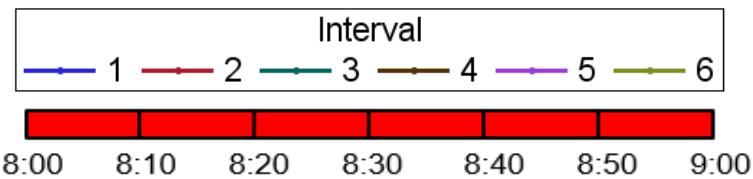
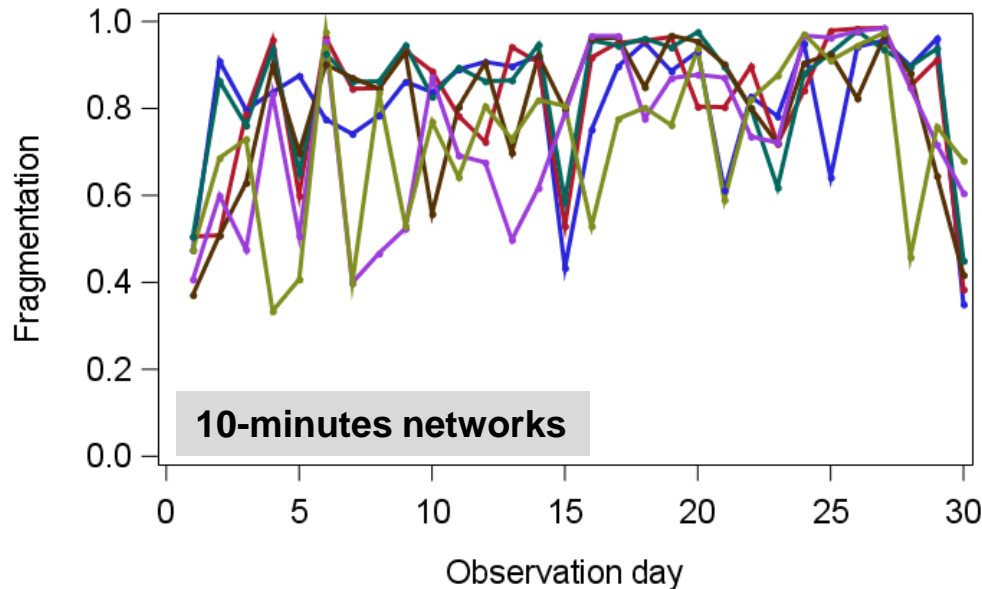
Density depending on the observation day and the chosen interval





Results & Discussion

Fragmentation depending on the observation day and the chosen interval





Summary

Density

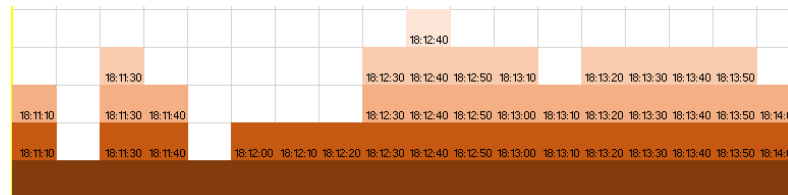
- In total small values
- Increasing intervals
 - Higher density
 - Same course of curves

Fragmentation

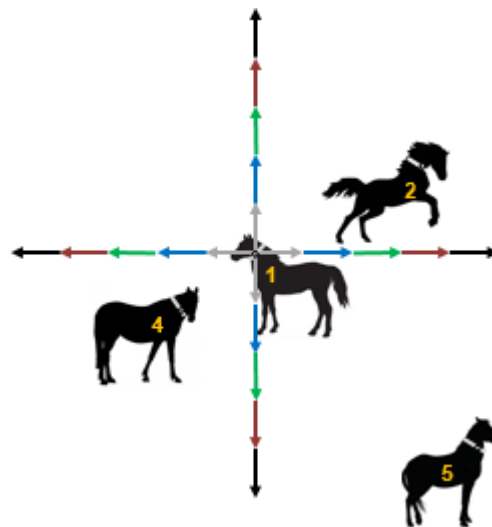
- A few smaller values → identifiable horse grouping → Indicator



- Allowance of interruptions between individual sampling points
→ Contact definition of **time**
- Variation of the contact definitions
→ Contact definition of **distance**
- Analysis of complete time period
→ Different network parameters
- Usage of different functional areas of the stable system
- Individual contacts between horses



Contact definition of **time**



Contact definition of **distance**



Thank you for your attention!



This study is kindly supported by

