Sensor technologies in animal agriculture: a general overview

Automated phenotyping symposium 29 September 2022

Malou van der Sluis

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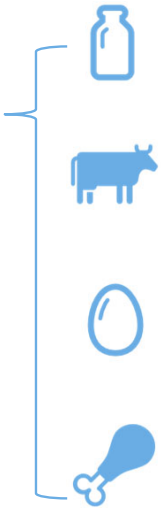
Increasing group sizes

- Balancing act between increasing production and reducing environmental impact → intensification[1]



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[1]Place (2018) 2

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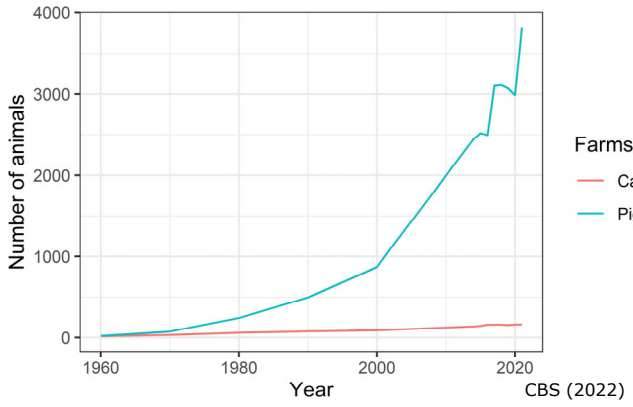
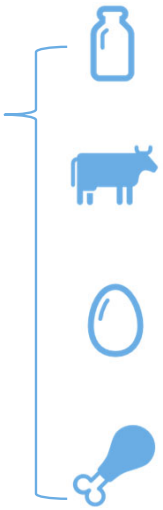
Increasing group sizes

- Balancing act between increasing production and reducing environmental impact → intensification[1]





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[1]Place (2018) 3

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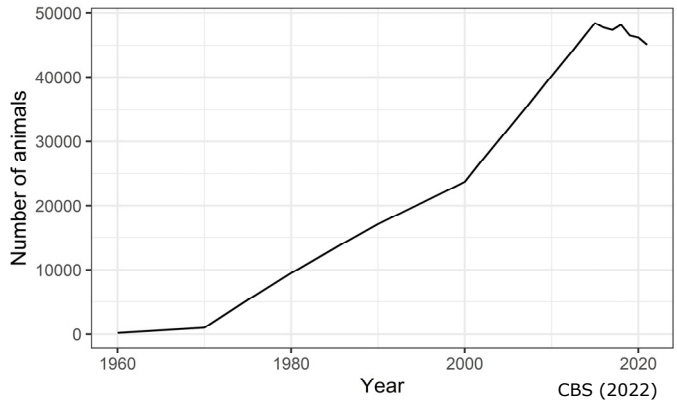
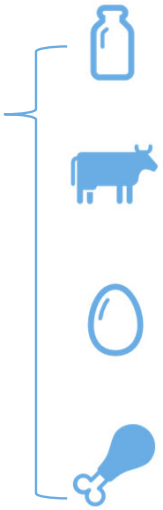
Increasing group sizes

- Balancing act between increasing production and reducing environmental impact → intensification[1]





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[1]Place (2018) 4

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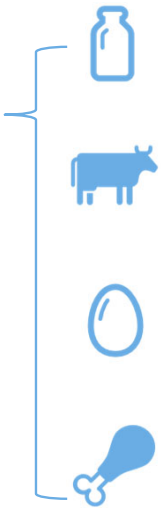
Increasing group sizes

- Balancing act between increasing production and reducing environmental impact → intensification[1]
  - Concerns about animal welfare[2]
  - How to keep track of these animals?



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[1]Place (2018); [2]Alonso et al. (2020) 5

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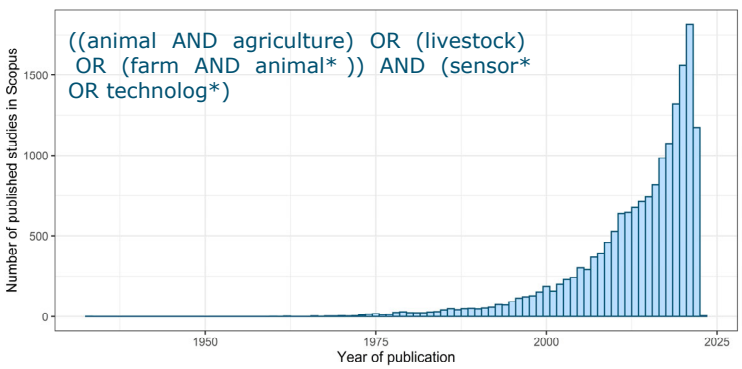
Sensor technologies in animal agriculture

- Individual records needed to assess animal welfare and for breeding
  - Time consuming, subjective

→ **Sensor technologies**



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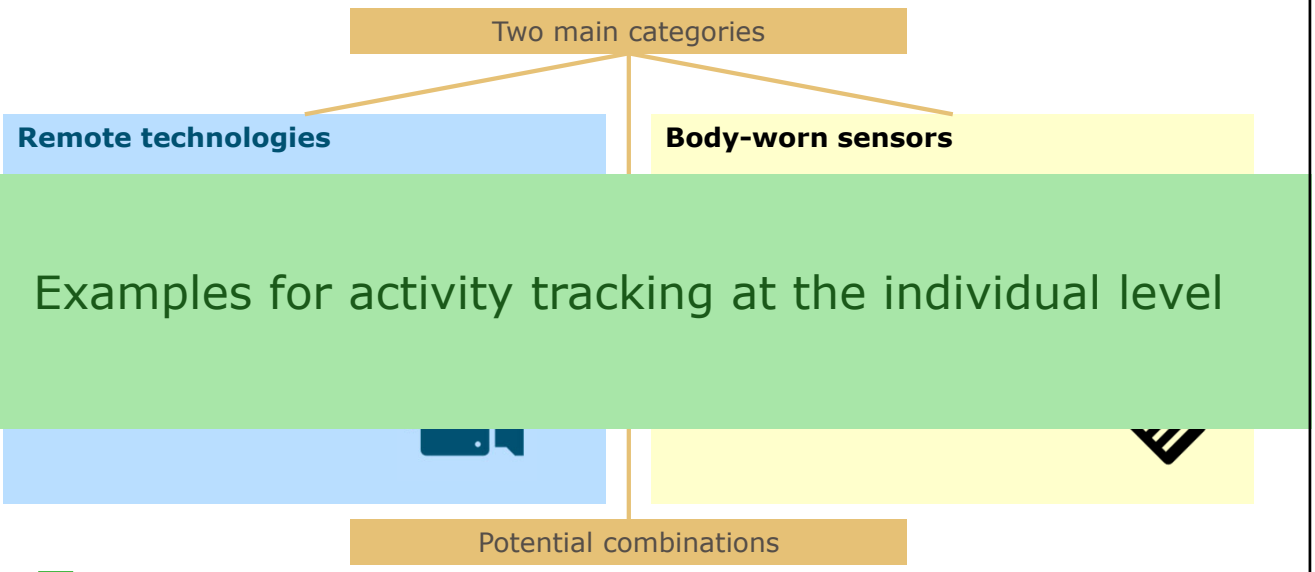
Different automated approaches



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Ellen et al. (2019) 7

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Example: CV to detect and track activity in pigs

- tracking-by-detection method: YOLOv3 and SORT algorithm
- 3 detection models: young, older, combined
- good accuracy detection algorithm
  - tracking better in enriched compared to barren environment
- manual corrections may be needed to keep track of individual

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van der Zande et al. (2021) 8

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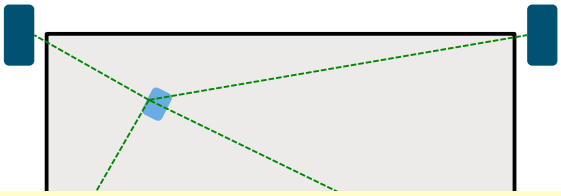
Example: Using UWB to track broiler activity

- tag: 3.8 x 3.9 cm, ~ 25 g
- from 2 weeks old
- coordinates
- correlation with video = 0.71
- good indication of relative activity level



Examples: also used for

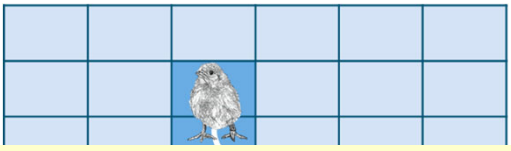
Commercial conditions (Baxter & O'Connell, 2020)

Free-range use (Stadig et al., 2018)

Gait score (van der Sluis et al., 2021)

Example: Using RFID to track broiler activity

- tag: 15 x 3.7 mm, < 1 g
- from 1 day old
- absence / presence
- rank correlation with video = 0.82
- good indication of relative activity level



Examples: also used for

Early life activity patterns (van der Sluis et al., 2022)

Estimating heritability of activity (Ellen et al., *under review*)

As input for video tracking (talk later today by Jan Erik Doornweerd!)

Potential benefits and downsides

Remote technologies

- Relatively cheap
- Non-invasive
- Individual identification challenging (e.g., need to use markings)

Body-worn sensors

- Individual-level data
- Difficult and expensive to upscale
- May affect animals (weight and size)

Potential combinations

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Ellen et al. (2019) 11

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General considerations

Species	• Are individuals easily identifiable? • How much can a body-worn sensor weigh?
Environmental	• Water, metal, visual obstacles in environment?
Level of detail	• Do you need detailed information or an estimate?
Timing	• At what age do you want to record the behaviour?
Behavioural proxies	• Are there perhaps other, associated behaviours that can be recorded as a proxy?

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Take home messages

- Great potential for sensor technologies in animal agriculture
- Depending on species, environment and (research) question, it may differ which approach is best suitable

Thank you!

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