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# Satisfying natural behaviour in dairy cows – Effects on welfare and production

Karin Schütz, AgResearch Ltd

NAWRDE, Melbourne 7 November 2018

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# Natural behaviours in dairy cows

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# Other natural behaviour

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# Which behaviours are important for welfare?

Grazing/Foraging (including manipulating feed, *Lindström & Redbo 2000*), resting and ruminating to maintain health and production

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# Lying behaviour

- Lying behaviour is an important welfare indicator (*Haley et al. 2000*)
- Cows on pasture spend 10-12 h/day resting
- Cows prefer and spend more time lying on soft and dry surfaces (*Tucker et al. 2003, 2009, Fregonesi et al. 2007, Schütz & Cox 2014*)

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# Lying behaviour

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- Cows prefer and spend more time lying on soft and dry surfaces (*Tucker et al. 2003, 2009, Fregonesi et al. 2007, Schütz & Cox 2014*)
- Lying deprivation is associated with:
  - acute and chronic stress (*Fisher et al. 2002, 2003, Tucker et al. 2007, Munksgaard et al. 1999*)
  - possible immunosuppression (*Chen et al. 2017, Davis et al. 2008*)
- Cows will lie down rather than eat after a period of deprivation of both (*Metz 1985*)

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# Which behaviours are important for welfare?

Adaptive behavioural responses to maintain normal body temperature and avoid heat and cold stress

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# Which behaviours are important for welfare?

Grooming and keeping clean important to health
*(Moncada et al. 2018, Schütz et al. 2018)*

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Grooming and keeping clean important to health
*(Moncada et al. 2018, Schütz et al. 2018)*

What does it mean to have a social bond (relative or friend)?

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# How important is access to pasture?

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# How important is access to pasture?

Pasture preference is complex: between 9 to >70% of time is spent on pasture

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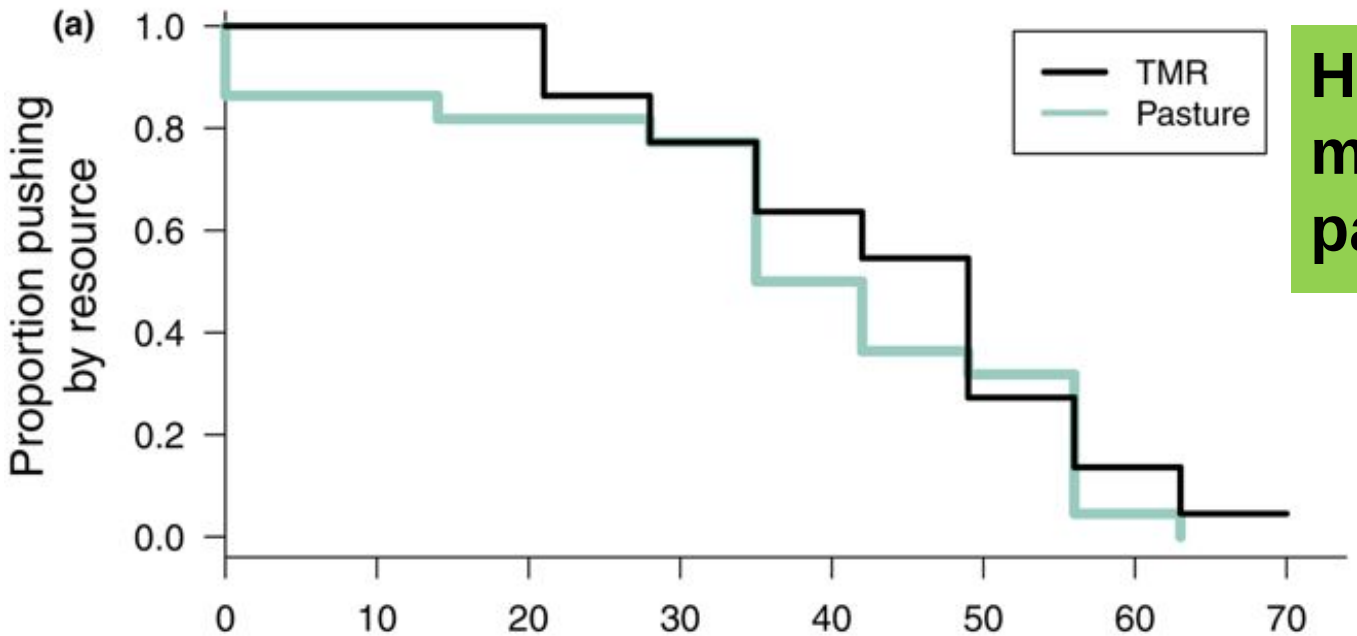
# Preference for pasture depends on several factors

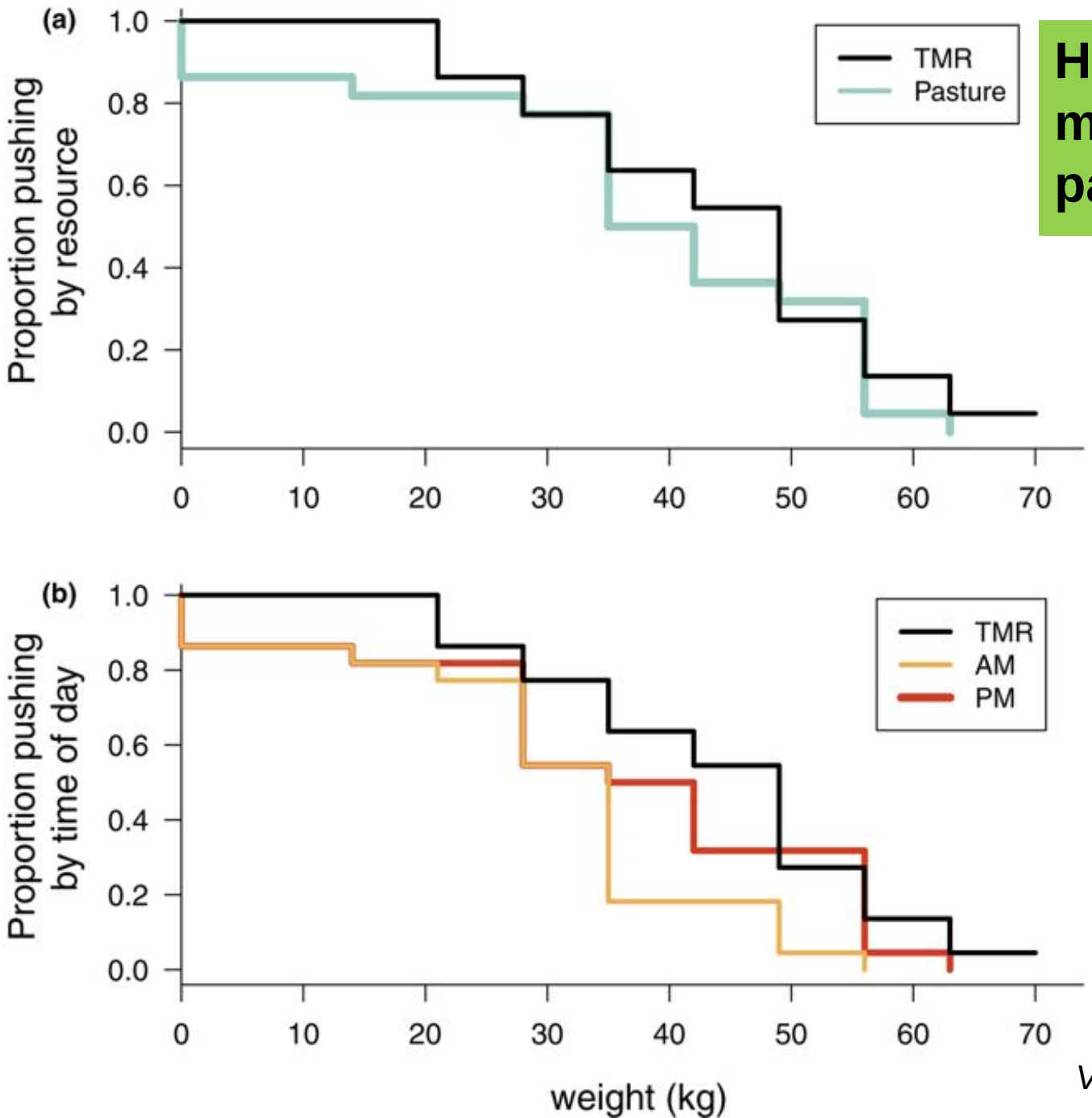
- Season *(Krohn et al. 1992, Charlton et al. 2011)*
- Weather conditions *(Legrand et al. 2009)*
- Location of food *(Charlton et al. 2011)*
- Distance between indoor housing and pasture *(Spörndly & Wredle 2004, Charlton et al. 2013)*
- Time of day *(Charlton et al. 2011, 2013, Legrand et al. 2009, Motupalli et al. 2014)*




**How strong is the motivation for pasture?**

weight (kg)

*Von Keyserlingk et al. 2017*




**How strong is the motivation for pasture?**

*Von Keyserlingk et al. 2017*

# Restriction of natural behaviour in dairy production systems?

| System | Self-groom | Turn around | Take several steps | Spend most of day in movement | Run/ play | Lie in all positions | Choose where to spend time[1] | Graze | Select diet[2] | Access roughage |
|---|---|---|---|---|---|---|---|---|---|---|
| Tethered calf stalls | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | Yes/no[3] | Yes/no[3] |
| Individual calf pens | Yes/ Limited[4] | Yes/ Limited[4] | ✗ | ✗ | ✗ | Limited/ No[4] | ✗ | ✗ | Yes/no[3] | Yes/no[3] |
| Group housed calves | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Yes/Limited[4,5] | ✗ | Yes/no[3] | Yes/no[3] |
| Calf hutches with yard | ✓ | ✓ | Yes/ Limited | Limited | ✗ | ✓ | Limited | ✗ | Yes/no[3] | Yes/no[3] |
| Tie stall without turnout | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ | ✓ |
| Freestall | ✓ | ✓ | ✓ | Yes/ Limited[5] | Limited[5] | Limited/ No[5] | Yes/ Limited[5] | ✗ | ✓ | ✓ |
| Drylot | ✓ | ✓ | ✓ | Yes/ Limited[5] | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ |
| Pasture | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

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# Natural behaviours restricted for a reason

Cow-calf bond

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# Natural behaviours restricted for a reason

Cow-calf bond

Grazing/foraging/access to pasture

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# How can natural behaviour be satisfied?

- Opportunities for natural behaviour can be given by providing more space and “high quality space”, eg for walking and resting

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# How can natural behaviour be satisfied?

- Opportunities for natural behaviour can be given by providing more space and “high quality space”, eg for walking and resting
- Providing resources, such as brushes, outdoor access and shade & shelter

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# How can natural behaviour be satisfied?

- Opportunities for natural behaviour can be given by providing more space and “high quality space”, eg for walking and resting
- Providing resources, such as brushes, shade & shelter and outdoor access
- Utilising alternative systems, eg to keep cow/calf together *(Johnsen et al. 2016)*



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# What are the benefits to welfare and production?

- Providing opportunities for natural behaviour is often an effective way to satisfy the needs of animals and provide emotionally positive experiences

- Benefits to welfare and production will depend on the behaviour and situation

# Mud & Wetness:

- **Reduce production** (*Stull et al. 2008*)
- **Increase the risk of lameness & mastitis** (*Borderas et al. 2004, Schreiner & Ruegg 2003*)
- **Increase energy requirements** (*Degen & Young 1993, Dijkman & Lawrence 1997*)
- **Reduce lying times** (*Fisher et al. 2003, Chen et al. 2017*)

*Photo courtesy: Grant Shackell*

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# Factors influencing decision making about satisfying natural behaviours

- Level of understanding
- Individual beliefs
- Cost/benefit information
- Practical solutions
- Financial drivers

- Public/consumer perception & values
- Retailers
- Available scientific information
- Animal welfare standards/frameworks

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# Summary

- Providing opportunities for expression of natural behaviour is effective to satisfy cow needs and promote positive experiences at the same time as maintaining health and production

- Information about natural behaviour in combination with what really matters to the animals can help guide development of management systems and provide solutions for issues in existing systems

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# Thank moo!

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# How strong is the motivation for pasture?

60m
140m
260m

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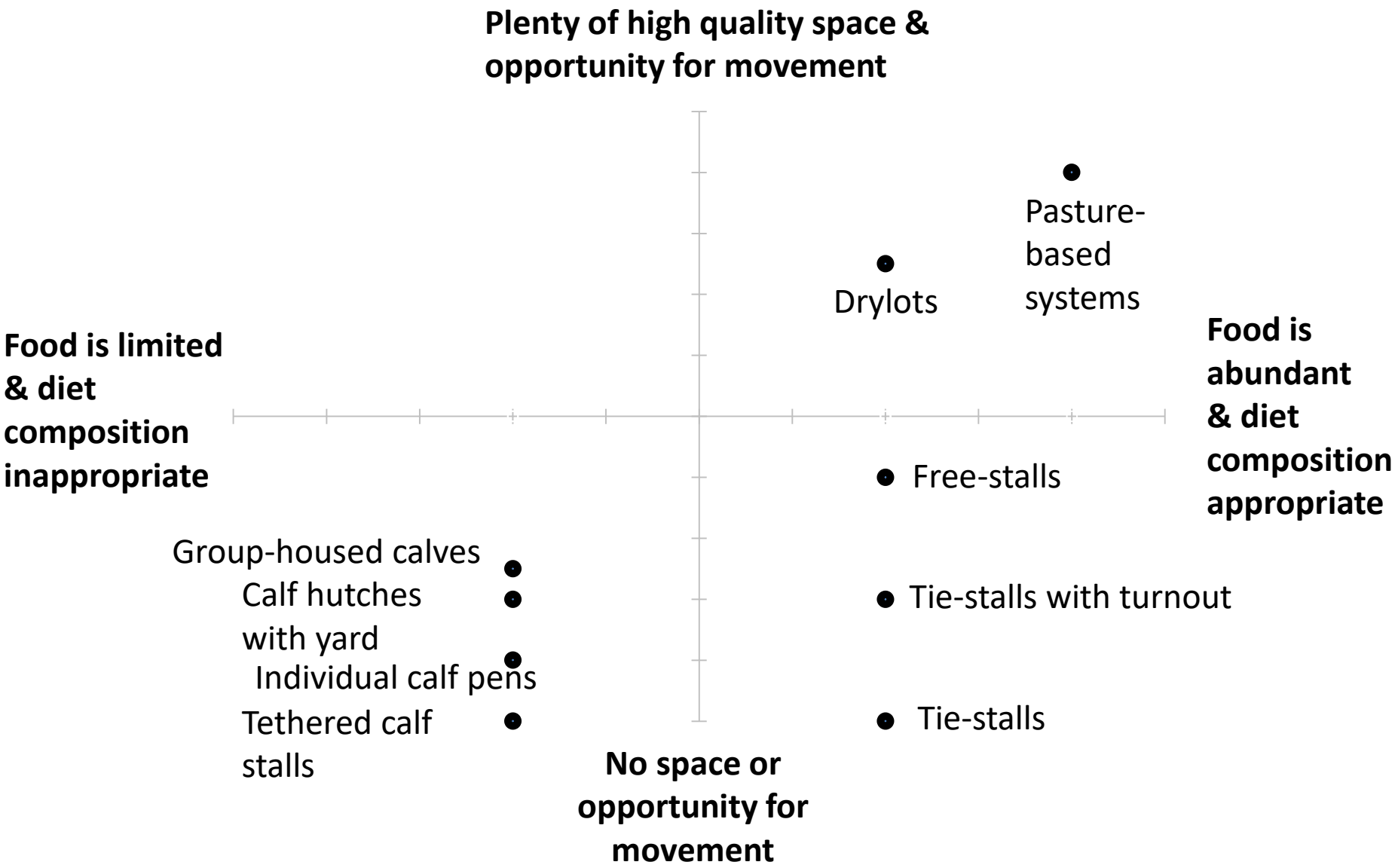
# How strong is the motivation for pasture?

- During the day, pasture use declined with increasing distance
- Cows were willing to walk longer distances at night to access pasture *(Charlton et al. 2013)*

60m
140m
260m


22 2 2010


Plenty of high quality space & opportunity for movement
Food is limited & diet composition inappropriate
Food is abundant & diet composition appropriate
No space or opportunity for movement
Pasture-based systems
Drylots
Free-stalls
Tie-stalls with turnout
Tie-stalls
Group-housed calves
Calf hutches with yard
Individual calf pens
Tethered calf stalls

# Satisfying natural behaviour in laying hens:
## Effects on welfare and production

**Dr Dana Campbell** | Research Scientist, CSIRO

November 7, 2018

# Laying Hen Industry

# Commercial Layer Production

Great-grandparent
Grandparent
Parent breeding flocks

→ Eggs to incubator

→ Day-old chicks to rearing farm

→ 16-17 week pullets to layer farm

→ Depopulation around 70+ weeks

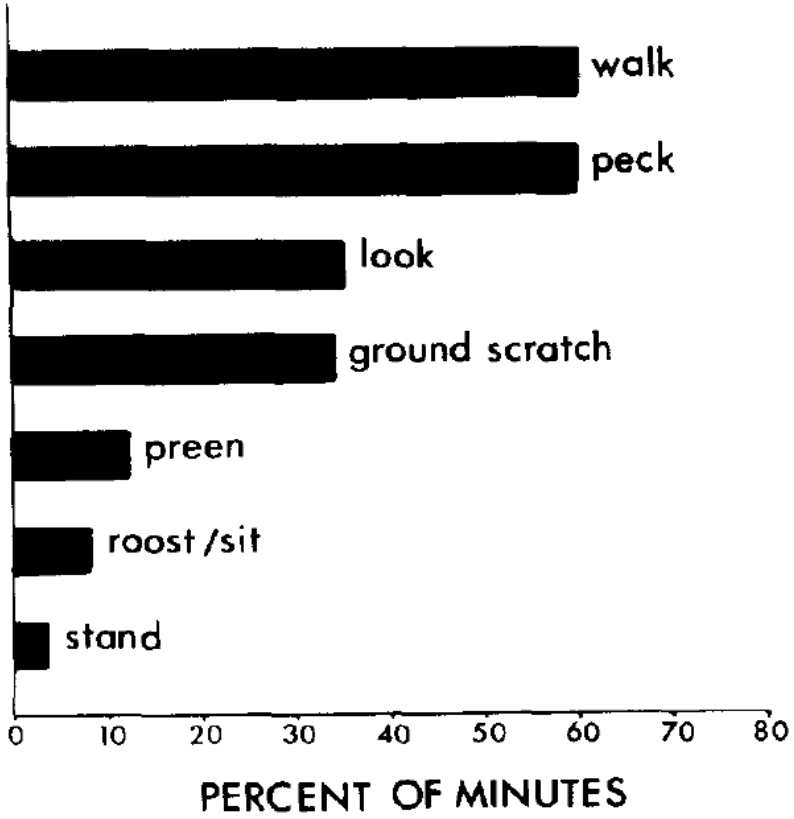
# Junglefowl Production

- Small groups – mixed sex
- Social hierarchy
- Territories
- Breeding season
- Hen-chick bond

# Domesticated Hens

# Junglefowl Behaviour

Time budgets of semi-wild junglefowl




*Dawkins, 1989*

# Modern Hen Behaviour

Nest box use

Foraging and scratching

Dust bathing

Perching

# Junglefowl vs. Modern Layer

- Modern layers exhibited energy-conserving behaviours (Schütz et al., 2001; Schütz and Jensen, 2001)
- Junglefowl exhibit more contrafreeloading (Lindqvist et al., 2002)
- Modern layers display low proportion of time foraging (Campbell et al., 2017)


# Measuring Behavioural Needs

- Observe daily patterns
- Sham dust bathing, pre-lay behaviour, foraging in feed troughs
- Remove resources
  - Frustration
- Preference testing

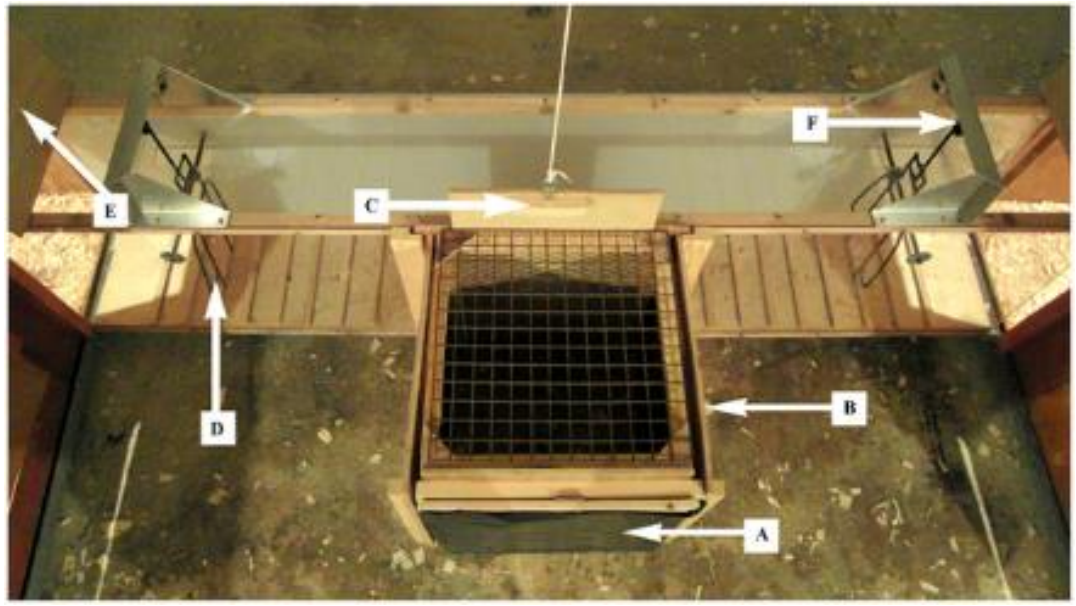



***Image: Behavioural and Physiological Effects of Finely Balanced Decision-Making in Chickens***
*A. C. Davies, C. J. Nicol, M. E. Persson, A. N. Radford*

# Behavioural Needs, Priorities, and Preferences

**(Weeks and Nicol, 2006)**

- Hens instinctively perform pre-lay/nest building behaviour – will work to gain access to an enclosed nest site
- Hens use perches and may work to gain access, preferentially roost high at night
- Foraging is a behavioural need, will still forage when there is a cost
- Dust bathing is a behavioural need, but the value placed on it is uncertain

## Abnormal behaviours

- Feather-pecking
- Aggression
- Cannibalism
- Smothering


Health
Natural behaviour
Production
Animal Well-Being
Stress
Disease
Emotional states

# Modern Layer (Enriched) Environments

# Additional Enrichments

# Problems of Commercial Layer Production

- Keel bone fractures
- Feather pecking
- Cannibalism
- Footpad dermatitis
- Disease spread
- Mortality
- Environmental conditions
- Reduced production

# Implementing 'Safe Enrichments'

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RESEARCH ARTICLE

## Soft Perches in an Aviary System Reduce Incidence of Keel Bone Damage in Laying Hens

Ariane Stratmann, Ernst K. F. Fröhlich, Alexandra Harlander-Matauschek, Lars Schrader, Michael J. Toscano, Hanno Würbel, Sabine G. Gebhardt-Henrich

Published: March 26, 2015 • https://doi.org/10.1371/journal.pone.0122568

## A review of environmental enrichment for laying hens during rearing in relation to their behavioral and physiological development

D L M Campbell, E N de Haas, C Lee

*Poultry Science*, pey319, https://doi.org/10.3382/ps/pey319

**Published:** 11 August 2018 **Article history**

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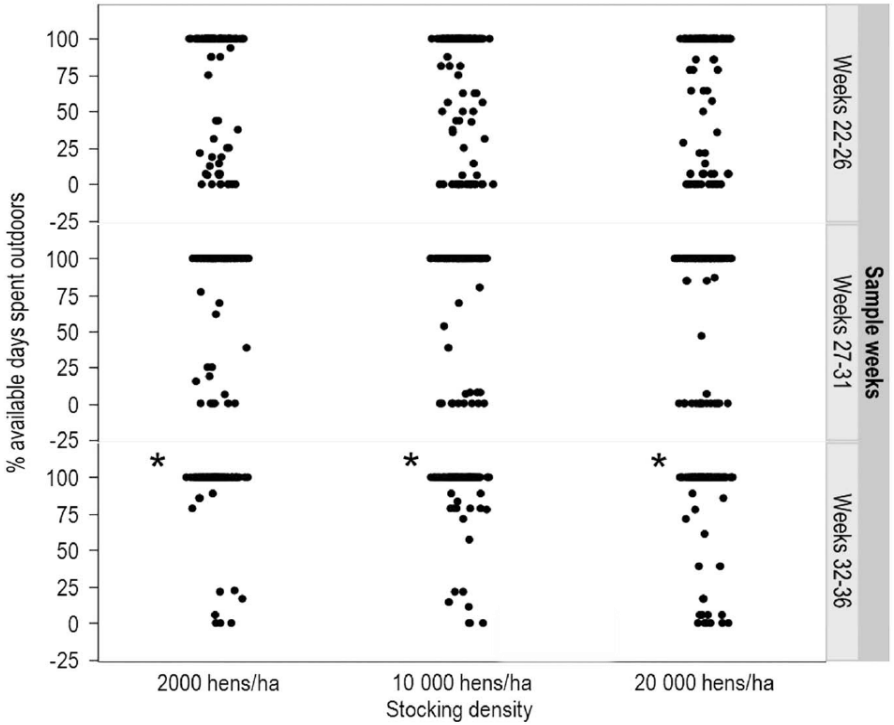
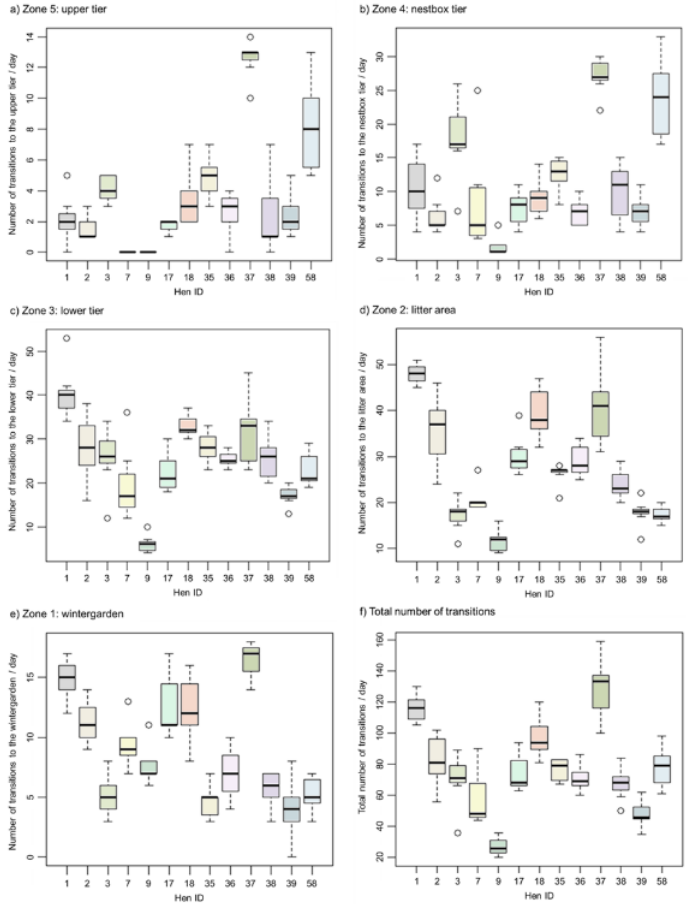
## Access to litter during rearing and environmental enrichment during production reduce fearfulness in adult laying hens

Margrethe Brantsæter, Fernanda M. Tahamtani, Janicke Nordgreen, Ellen Sandberg, Tone Beate Hansen, T.Bas Rodenburg, Randi Oppermann Moe, Andrew Michael Janczak

# Individual Variation




*Campbell et al., 2017*




*Rufener et al., 2018*

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# Animal Health & Well-Being

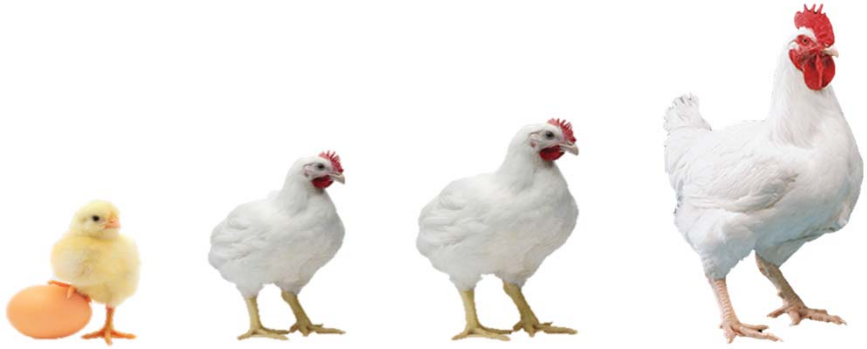
**KEY: HOUSING TYPES** EC *Enriched Colony* **(EC)** | AV *Cage-Free Aviary* **(AV)** | CC *Conventional Cage*

| | NEGATIVE IMPACT | | | | CC | POSITIVE IMPACT | | | |
|---|---|---|---|---|---|---|---|---|---|
| **IMPACT SCALE** | -4 *Exceptionally Worse* | -3 *Substantially Worse* | -2 *Worse* | -1 *Slightly Worse* | 0 *Similar* | +1 *Slightly Better* | +2 *Better* | +3 *Substantially Better* | +4 *Exceptionally Better* |
| **Mortality** | | | AV | AV | EC | | | | |
| **Behavior** | | | | | EC, AV | EC, AV | EC, AV | EC, AV | |
| **Cannibalism/Aggression** | | AV | AV | AV, EC | EC | | | | |
| **Keel Damage** | | AV | AV | AV, EC | EC | | | | |
| **Tibia/Humerus Strength** | | | | | EC, AV | EC, AV | EC, AV | | |

# Conclusions

- Natural behaviours are important for laying hens
- Enrichments, particularly housing design will increase expression
- Housing design can also have negative impacts on health, behaviour, welfare
- Research to continue optimising system design is necessary
- Critical to understand the interplay between hen welfare, ethics, economics, and commercial feasibility

# Satisfying natural behaviour in meat chickens, effects on welfare and production



Dr Peta Taylor

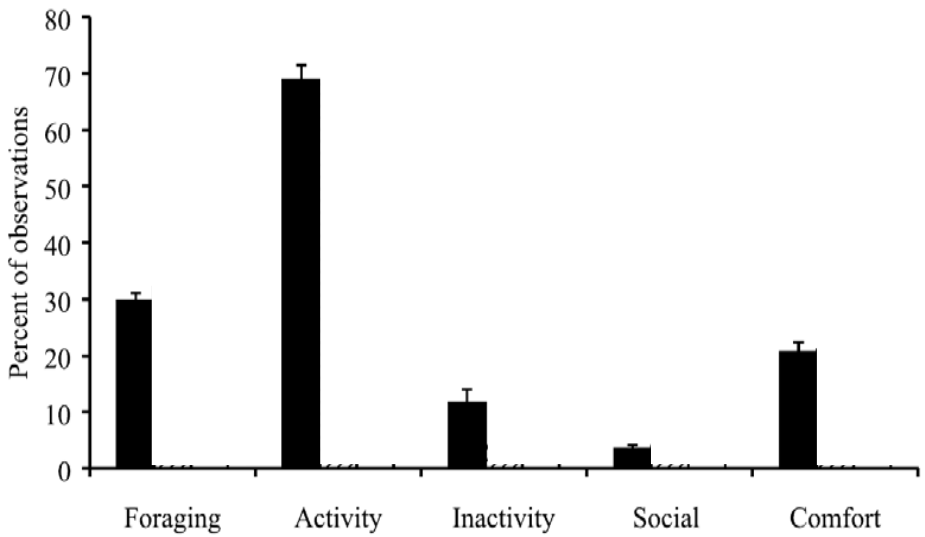
University of New England

# Meat chicken behaviour & welfare

- Why has the behavioural time budget changed, and does it matter?
- What has shown to alter behaviour & what are the implications for welfare
- A new approach?

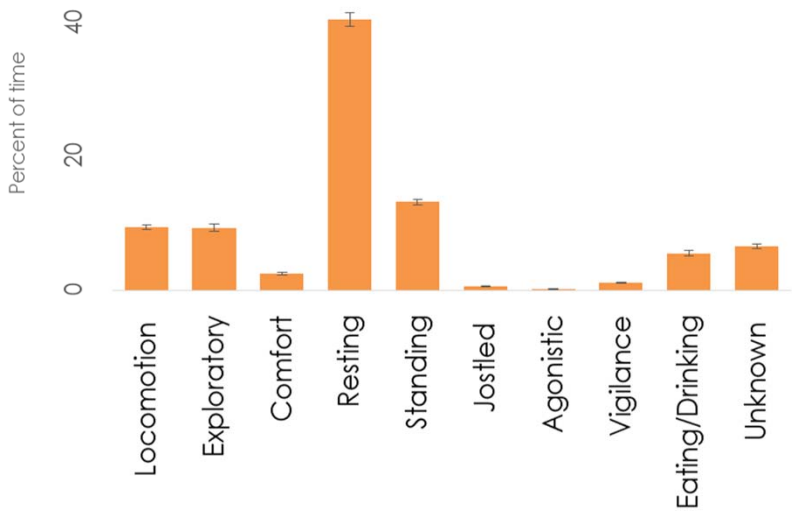
# Red Jungle Fowl time budget

Schütz & Jensen (2001)



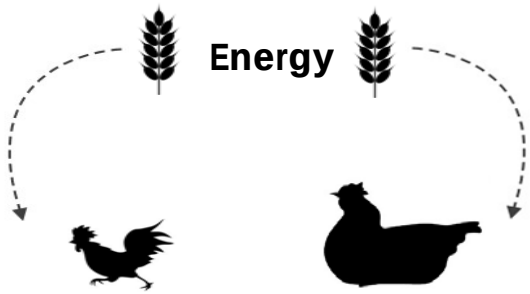

# Meat chicken time budget

Taylor, et al., (2015)



# What has altered meat chickens behavioural time budget?

Resource allocation




Morphology

Environment

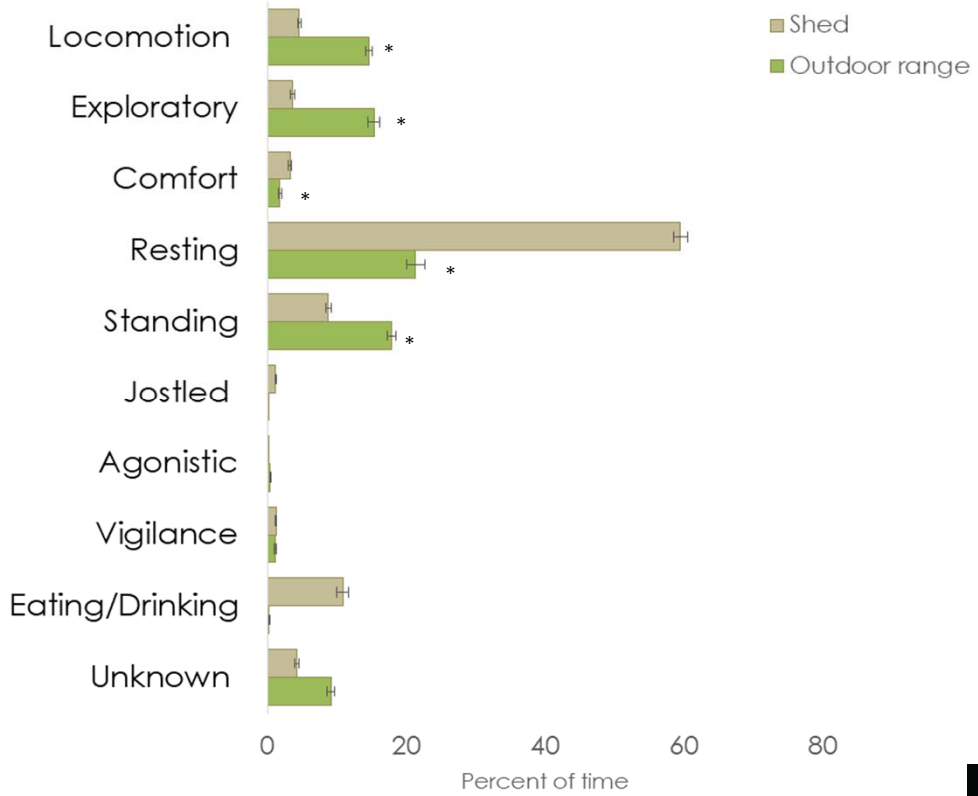
**Reduced motivation**

**Restriction**

# Environment

## Free-range meat chicken time budget

Taylor, et al., (2015)



# Environment

Use

Heterogeneous
Season dependent
Increased 2 weeks then stabilised

Welfare

↑ leg health
↑ plumage cover
↓ fearfulness & stress physiology

Risk

↓ Growth rate
Litter quality & FPD (Haslam et al., 2006; Pagazaurtundua & Warriss, 2006; Dal Bosco et al., 2010)

(Taylor et al., 2017a, 2017b, 2018)

# Environment

## Pecking objects

Use

2%

Welfare

↔ Fearfulness, growth, stress physiology or leg health

(Taylor et al., 2015)

# Environment

## Perches & platforms

Use

2 – 25 %
Platform preference (Bailie & O'Connell, 2016)
↑ with ↑ SD

Welfare

↑ Leg health (Groves & Muir, 2013; Kaukonen et al., 2016)
↔ Leg health (Bailie and O'Connell, 2015; Su et al, 2000; Ventura et al, 2010)
↓ FPD (Ventura et al., 2010)

Risk

Breast burn/blisters (Bessei, 2007)

# Environment

## Hay bales & Barriers

Use

Cluster (Kells et al, 2001; Bailie et al, 2013; Bergmann et al, 2017)

Welfare

↑ Leg health (Bailie et al., 2013)

Altered tibia morphology (Bizeray et al., 2002)

Risk

Biosecurity risk

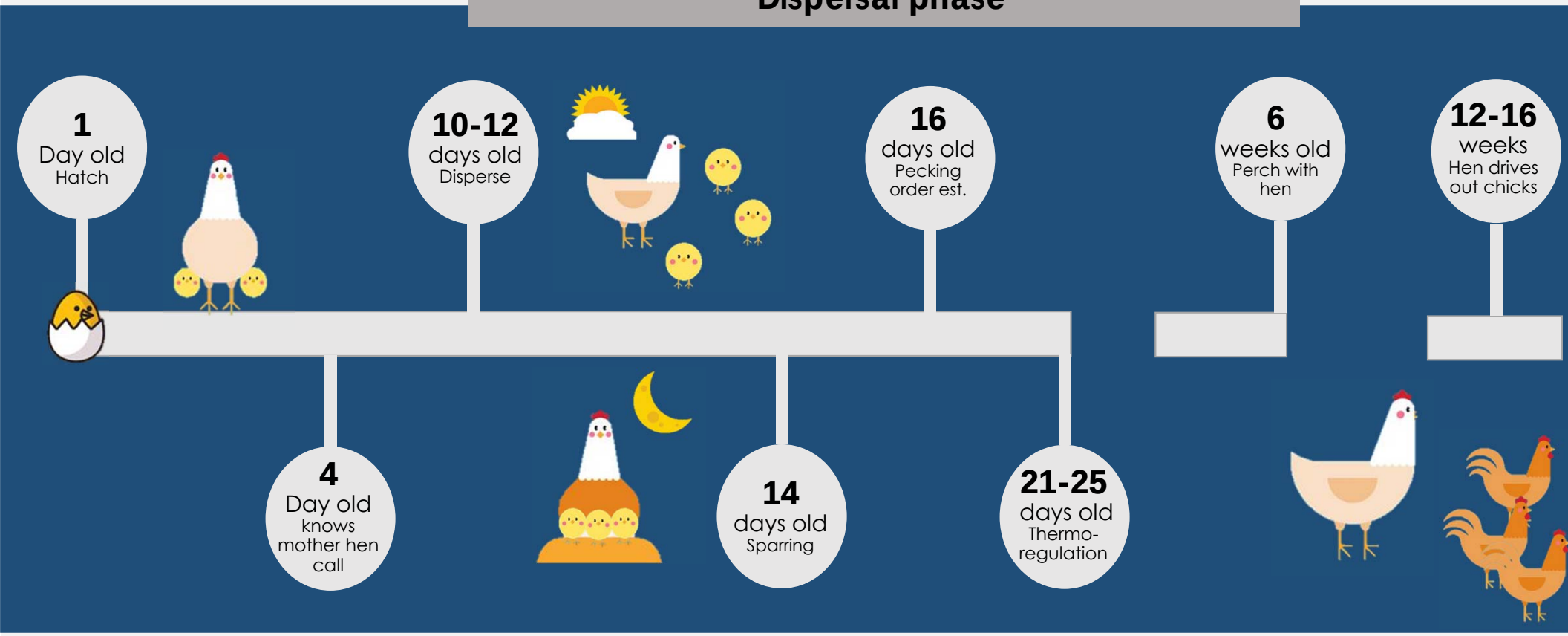
↑ mortality (Gordon & Forbes, 2002)



Bergmann et al., 2017

Can we attempt to use natural behaviour / natural environment to develop effective enrichment programs for meat chickens?

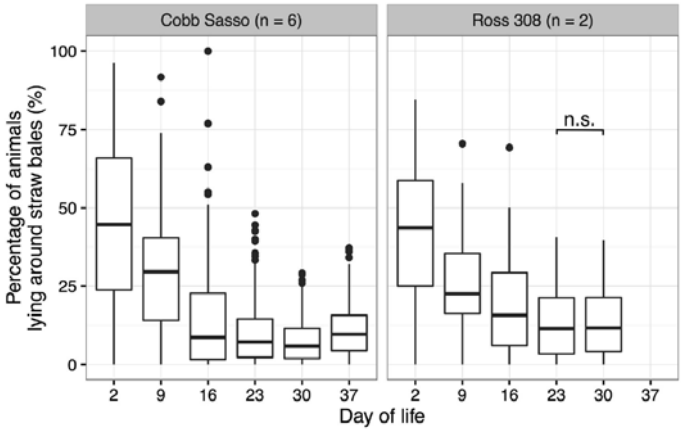
# Dispersal phase



Can the provision of particular characteristics of the maternal environment improve meat chicken behaviour and welfare?

# Maternal Environment

## Darkness & warmth

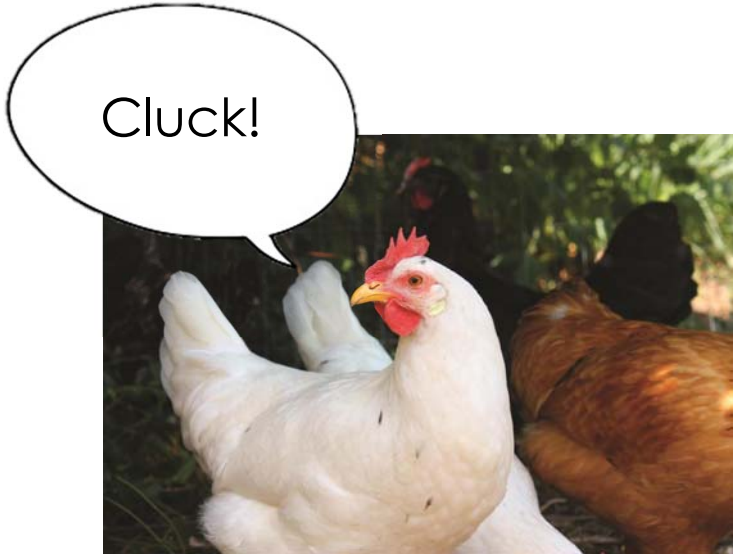


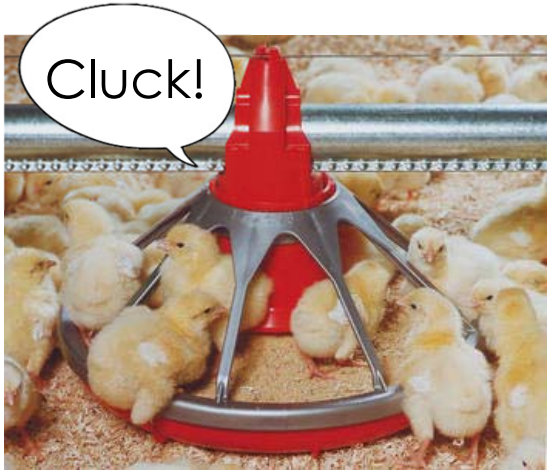

Bergmann et al., 2017

| Practical mimicry | Outcome |
|---|---|
| 40min:40min L:D | ↑ Rest, ↔ FCR, ↔ Growth (Malleau et al., 2007) |

# Maternal Environment

## Vocalisations




| Practical mimicry | Outcome |
|---|---|
| Vocalisation playback | ↓ chick stress response (Edgar et al., 2015) |
| | ↓ FCR, ↑ body weight (Woodcock et al., 2004) |

# Maternal Environment

## Olfaction

| Practical mimicry | Outcome |
|---|---|
| Hen preen gland secretions (MHUSA) | ↓ stress response, ↔ body weight, ↑ carcass weight, ↓ downgrades at slaughter (Madec et al., 2008) |

| | Males | | Females | |
|---|---|---|---|---|
| | Control | MHUSA | Control | MHUSA |
| Suffocated (%) | $1.11^{a} \pm 0.11$ | $1.36^{b} \pm 0.12$ | $6.36^{c} \pm 0.24$ | $3.25^{d} \pm 0.18$ |
| Scratched (%) | $22.0^{a} \pm 0.41$ | $8.0^{b} \pm 0.27$ | $19.0^{c} \pm 0.39$ | $10.0^{d} \pm 0.30$ |

# Conclusions

- The welfare implications of meat chicken behaviour are not fully understood, but will reveal the implications for welfare
- Mimicking the maternal environment may improve welfare
- Care must be taken before recommendations are made

# Acknowledgements

Professor Jean-Loup Rault
Professor Paul Hemsworth
Professor Peter Groves
Dr Sabine Gebhardt-Henrich
AWSC staff & students

University of New England

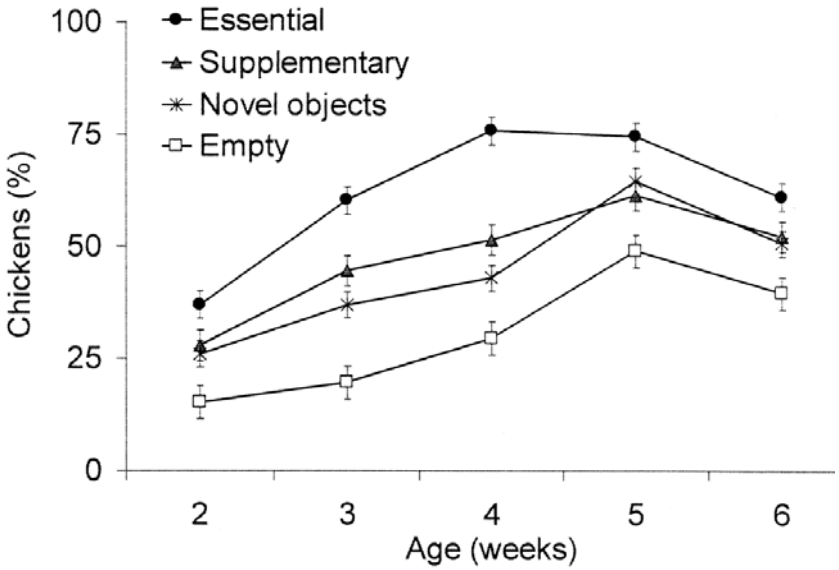
Use

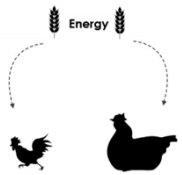
# Environmental enrichment

## What do chickens want?

Newberry (1999)

1. Essential resources: Heat, food & water
2. Supplementary resources: Peat moss, hay bales
3. Novel objects
4. No resources



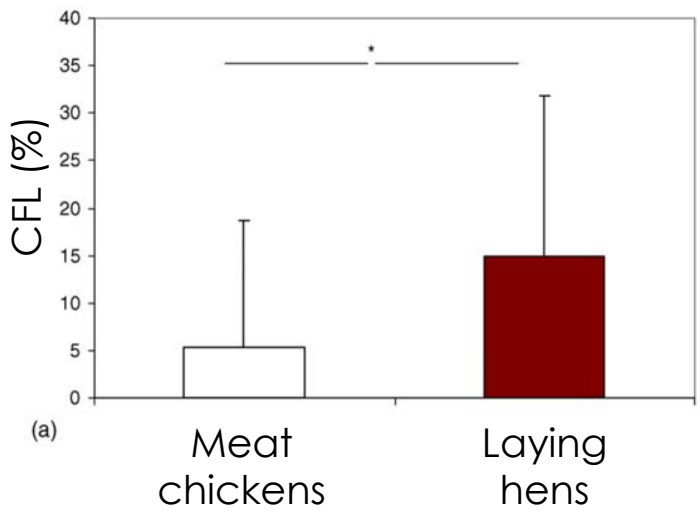



# Resource allocation theory

Energy conservation for growth is achieved by reducing motivation to perform other energy-demanding behaviours

## Contrafreeloading (CFL)

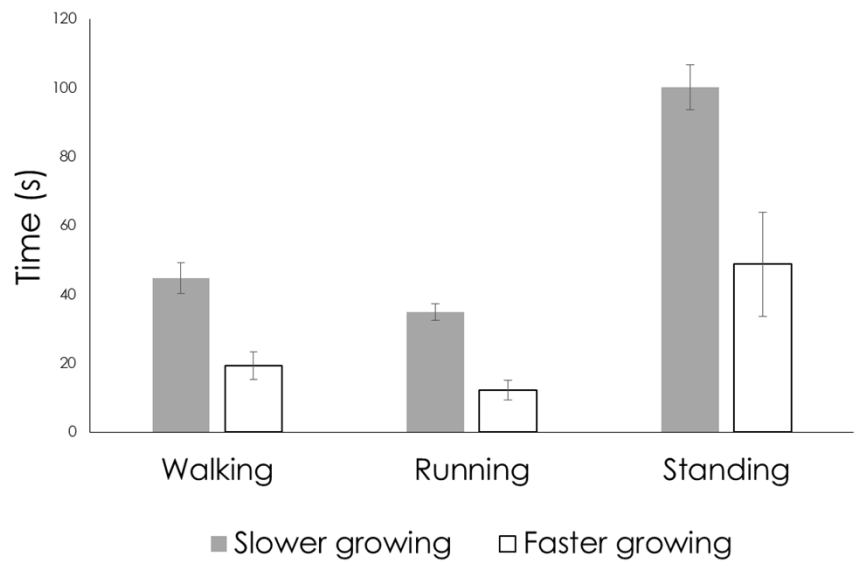
Lindqvist et al., (2006)




## Age

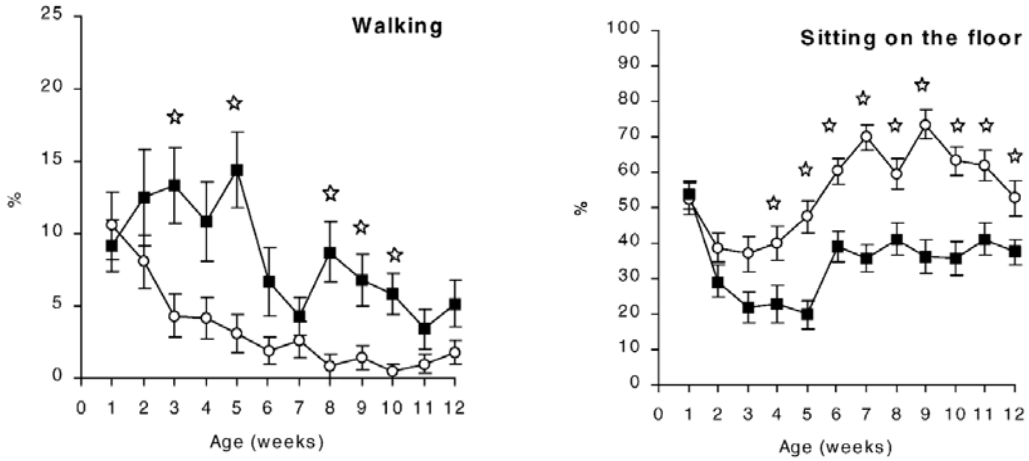
Bizeray et al., (2000)

2 – 3 days of age



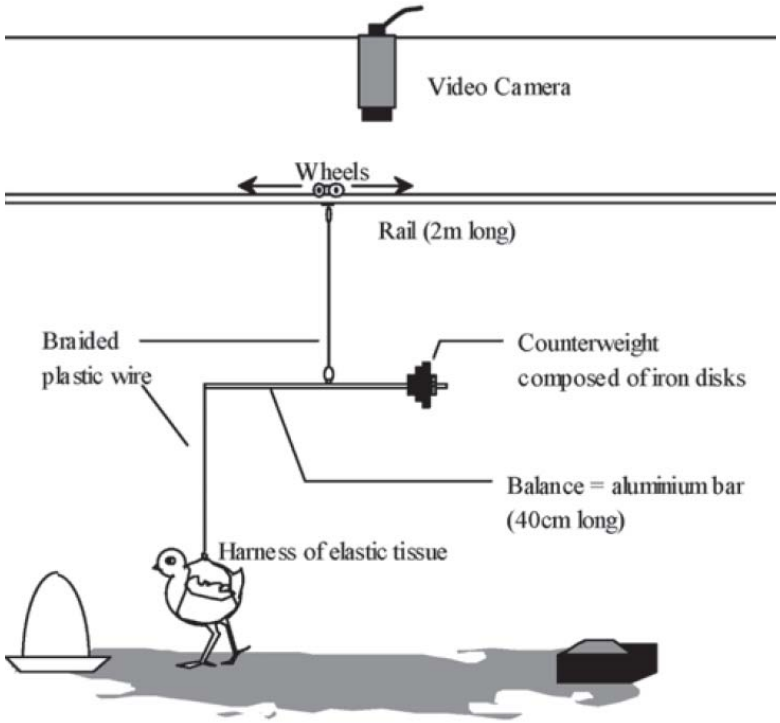
# Morphology

Reduction in activity by around 4-5 weeks of age is well known and documented




Faster growing (○) Slower growing (■)

Bokkers & Koene (2003)




Rutten et al., 2002