Livestock Emotions, Vocalisations and Positive Welfare

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https://www.cityu.edu.hk/cahw/
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• Five Freedoms, Five Domains, Positive Animal Welfare
• Goat Vocalisations and Welfare
• Chicken Vocalisations, Welfare and AI
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Goat Vocalisations and Welfare
Chicken Vocalisations, Welfare and AI
Animal Welfare – Five Freedoms

➢ 1. Freedom from Hunger and Thirst (Nutrition)

➢ 2. Freedom from Discomfort – shelter and comfortable resting area (Environment)

➢ 3. Freedom from Pain, Injury or Disease (Health)

➢ 4. Freedom to Express Normal Behaviour - sufficient space, proper facilities and company of the animal’s own kind (Behaviour)

➢ 5. Freedom from Fear and Distress – avoid mental suffering (Mental State)

*Developed in response to 1965 UK Government Brambell report on livestock husbandry, formalized in 1979.*
**Five Domains and Positive Animal Welfare**


Animal Welfare should not only be evaluated by the absence of negative states but also by the presence of “Good Life” or “Positive Experiences” enjoyed by animals.

### Physical/Functional Domains

#### Survival-Related Factors

<table>
<thead>
<tr>
<th>Physical Restriction/Capability</th>
<th>1: Nutrition</th>
<th>2: Environment</th>
<th>3: Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restrictions on:</td>
<td>Unavailable/imposed conditions</td>
<td>Available conditions</td>
<td>Presence of:</td>
</tr>
<tr>
<td>Water intake</td>
<td>Drink enough water</td>
<td>Thermal extremes</td>
<td>Disease: acute, chronic</td>
</tr>
<tr>
<td>Food intake</td>
<td>Eat a balanced diet</td>
<td>Thermally tolerable</td>
<td>Injury: acute, chronic</td>
</tr>
<tr>
<td>Food quality</td>
<td>Eat a variety of foods</td>
<td>Suitable substrate</td>
<td>Acute/chronic musculoskeletal</td>
</tr>
<tr>
<td>Food variety</td>
<td></td>
<td>Space for free movement</td>
<td>Mutilations</td>
</tr>
<tr>
<td>Voluntary overeating</td>
<td>Eating correct quantities</td>
<td>Free air</td>
<td>Functional impairment: due to limb amputation, or lung, heart, vascular, kidney, neutral or other problems</td>
</tr>
<tr>
<td>Forced feeding</td>
<td></td>
<td>Pleasant/unpleasant odours</td>
<td>Poisoning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Light: inappropriate intensity</td>
<td>Body condition appropriate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Loud/unpleasant unpleasant noise</td>
<td>Good fitness level</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Environmental monitoring: ambient, physical lighting</td>
<td>Limits on threat avoidance, escape or defensive activity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unpredictable events</td>
<td>Limitations on sleep/rest</td>
</tr>
</tbody>
</table>

### Affective Experience Domain

#### 5: Mental State

<table>
<thead>
<tr>
<th>Mental State</th>
<th>Negative</th>
<th>Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thirst</td>
<td>Wetting/squashing pleasures of drinking</td>
<td>Positive forms of comfort:</td>
</tr>
<tr>
<td>Hunger (general)</td>
<td>Pleasures of different tastes/odors</td>
<td>Breathe/exhale</td>
</tr>
<tr>
<td>Hunger (sat)</td>
<td>Pleasure of salt taste</td>
<td>Physical:</td>
</tr>
<tr>
<td>Malnutrition</td>
<td>Stomach pain</td>
<td>Sensory:</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>Gastrointestinal discomfort</td>
<td>Auditory:</td>
</tr>
</tbody>
</table>

### Welfare Status

Positive Welfare, e.g. providing animals with opportunities to make their own decisions (agency), or to have positive social relationships.
Positive Animal Welfare and Emotions

*Emotions - intense, short, affective reactions to information*

**Dimensional Approach**

**Components**

- **Cognition** (e.g. learning, decision-making)
- **Behaviour** (e.g. movement, ear postures)
- **NeuroPhysiology** (Heart rate, HRV)
- **Subjective** (Humans)

(Russell 2003; Mendl et al. 2010)
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Goat Emotions: Expression and Perception

*Treatments (N = 22 goats)*

Four Treatments of different emotional Arousal and Valence:

➢ **Control**
  (eating hay – neutral)

➢ **Food Anticipation**
  (high arousal/positive)

➢ **Food Frustration**
  (low arousal/negative)

➢ **Isolation**
  (high arousal/negative)

Measured 23 different Physiological, Behavioural and Vocal Parameters

Key Result

- Pitch (Fundamental Frequency, F0) of Vocalisations More Stable in Positive Treatments versus Negative Treatments
"Iceberg Indicator" of Animal Welfare
Goats and Emotion-linked Vocalisations

Emotions in goats: mapping physiological, behavioural and vocal profiles

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- coping
- emotion
- emotions
- vocalizations
- valence
- social functions

Emotions are important because they enable the selection of appropriate behavioural decisions in response to external or internal events. Techniques for understanding and assessing animal emotions, and particularly positive ones, are lacking. Emotions can be characterized by two dimensions: their arousal (bodily excitation) and their valence (negative or positive). Both dimensions can affect emotions in different ways. It is crucial to assess their effects on biological parameters simultaneously, so that accurate indicators of arousal and valence can be identified. To find convenient and non-invasive tools to assess emotions in goats, Capra hircus, we measured physiological, behavioural and vocal responses of goats in four situations: (1) control (no external stimulus, neutral); (2) anticipation of a food reward (positive); (3) food-related frustration (negative); (4) isolation away from companions (negative). These situations were characterized by different levels of arousal, assessed a posteriori by heart rates measured during the tests. We found several clear, reliable indicators of arousal and valence. During situations of higher arousal, goats had lower heart rate variability and higher respiratory rates. They displayed more head movements, moved more, had their ears pointed forwards more often and on the side (horizontal) less often and produced more calls. They also produced calls with higher fundamental frequencies and higher energy distribution. In positive situations, goats had their ears oriented backwards less often and spent more time with their tails up than in negative situations. Furthermore, they produced calls in which the fundamental frequencies were less variable. Our methods for assessing the effects of emotional arousal and valence on biological parameters could lead to more effective monitoring and understanding of animal emotions, as well as to a better understanding of the evolution of emotions through cross-species comparisons. © 2014 The Association for the Study of Animal Behaviour. Published by Elsevier Ltd. All rights reserved.

Goats distinguish between positive and negative emotion-linked vocalisations

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Broiler Chicken Vocalisations and Welfare (2015-2018, UK)

Recordings using 12 commercial sheds (25,000–27,000 chickens per shed)
In early life, output of distress calls predicts low weight gain and high mortality not only into the next day, but by end of cycle (Day 32).


Spectral entropy describes complexity of a system; in bioacoustic data, low values reflect pure, tonal sounds while high values approach white noise.
Chicken Vocalisations, Welfare and AI (2017-2019, China)

- Build an Automated monitoring system (Precision Livestock Farming) for identifying Chicken Distress Vocalisations.
- Guangxi Veterinary Research Institute
- Chickens in cages, 2000 – 2500 per shed
Developed an algorithm to automatically identify chicken distress calls.
Correctly identify 97% of distress calls, among other farm sounds.
Take Home Messages

• Positive Animal Welfare is Vital for Livestock Health, Productivity

• Vocalisations can be used for monitoring Health and Welfare of Livestock, especially in large groups

“Our end goal is not to count distress calls, but to create conditions in which the chickens can live and have a reduced amount of stress…”
Funding - Thanks....

Buttercups Sanctuary for Goats

BBSRC, UK

Swiss National Science Foundation

Swiss Federal Veterinary Fund