Animal Welfare Science and Bioethics Centre

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Broadening Our Perspectives on Negative and Positive Animal Welfare Impacts

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Areas considered

• Introduction
• A focus on pain
• Giving more definition to distress
• Sources of negative experiences or affects: motivational urges and drives
• Positive subjective experiences or affects
• Concluding remarks
Areas considered

• **Introduction**
  – Source publications, animal welfare and lab-induced impacts

• **A focus on pain**

• **Giving more definition to distress**

• **Sources of negative experiences or affects:**
  - *motivational urges and drives*

• **Positive subjective experiences or affects**

• **Concluding remarks**
Introduction – source publications


Introduction – animal welfare

• AW is a state within an animal
• It is what the animal experiences
• It is the integrated outcome of:
  – *Internally generated* sensory inputs
  – *Externally generated* sensory inputs
  – Giving rise to *subjective, emotional or affective states*
  – Experienced consciously
• There has been a strong emphasis on –ve states
  – Thirst, hunger, pain, anxiety, fear, loneliness, boredom
• Increasingly +ve states are being emphasised
Introduction – lab-induced impacts

• The Three Rs focus on minimising –ve experiences
• Yet, in the past, the list was nonspecific and/or limited
• An expanded list would aid Three Rs applications
• Understanding sources of –ve experiences has increased the list which now would include both:
  – Undoubtedly negative experiences or affects
  – An absence of positive experiences or affects
• Increase in empathetic commitment to the Three Rs
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A focus on *pain*

- Early regulatory emphasis was on *pain* and *distress*
- A focus on pain was and is worthwhile
- Helps address many factors that compromise welfare
- This is because pain has:
  - Many causes – injuries and disease-induced pathologies
  - Many manifestations – acute, chronic, localised, generalised, physical, emotional, adaptive, maladaptive
  - More than one type may be present at the same time
# Some Manifestations of pain

<table>
<thead>
<tr>
<th>Aching</th>
<th>Burning</th>
<th>Beating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throbbing</td>
<td>Shooting</td>
<td>Bursting</td>
</tr>
<tr>
<td>Boring</td>
<td>Sharp</td>
<td>Smarting</td>
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<tr>
<td>Drawing</td>
<td>Hot iron</td>
<td>Electricity</td>
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<tr>
<td>Pulling</td>
<td>Soreness</td>
<td>Stinging</td>
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<tr>
<td>Gripping</td>
<td>Knife-like</td>
<td>Pricking</td>
</tr>
<tr>
<td>Cramping</td>
<td>Stabbing</td>
<td>Needle-like</td>
</tr>
<tr>
<td>Nagging</td>
<td>Toothache</td>
<td>Tingling</td>
</tr>
<tr>
<td>Sense of pressure</td>
<td>Tearing</td>
<td>Itching</td>
</tr>
<tr>
<td>Gnawing</td>
<td>Hot cords</td>
<td></td>
</tr>
</tbody>
</table>

A focus on pain

• Early regulatory emphasis on pain and distress
• The focus on pain was worthwhile
• Helps address many factors that compromise welfare
• This is because pain has:
  – Many causes – injuries and disease-induced pathologies
  – Many manifestations – acute, chronic, localised, generalised, physical, emotional, adaptive, maladaptive
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Clearly a focus on pain and its alleviation has direct relevance to refinement in the laboratory context
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Giving more definition to distress

• 30 years ago distress served as a catch-all term for –ve experiences (other than pain) without specifying them

• An underestimation of –ve effects may have resulted

• Specification of particular types focuses attention for more effective refinement activity

• 1979 Five Freedoms noted: thirst, hunger, discomfort and fear, in addition to pain and distress

• Today, the list is much longer, and growing
For example: The Five Domains

**PHYSICAL COMPONENTS**

- **Domain 1: Nutrition**
  - Water deprivation
  - Food deprivation
  - Malnutrition

- **Domain 2: Environment**
  - Environmental Challenge

- **Domain 3: Health**
  - Disease
  - Injury
  - Functional Impairment

- **Domain 4: Behaviour**
  - Behavioural or Interactive restriction

**MENTAL COMPONENTS**

- **Domain 5: Mental State**
  - Thirst
  - Hunger
  - Pain (short lived)
  - Nausea
  - Fear
  - Deblility
  - Weakness
  - Sickness
  - Pain (moderate)
  - Dizziness
  - Breathlessness
  - (Transient, curable)
  - Anxiety
  - Helplessness
  - Isolation
  - Boredom
  - Frustration
  - Distress
  - Pain (persistent, untreatable)
  - Breathlessness
  - (incurable)

**Animal Welfare Status**
Giving more definition to *distress*

- This list remains *open-ended* by use of the phrase ‘*and other forms of distress*’

- This *expanded list* has two advantages:
  - Being *explicit* it provides *guidance* about *possible targets* for refinements to mitigate –ve impacts in the lab and generally
  - Being *open-ended*, it highlights that additional forms of distress might be caused by our treatment of animals and should be evaluated as other possibilities for *refinement or mitigation*
Giving more definition to *distress*

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*Specifying a wider range of –ve experiences requiring mitigation will enhance the overall effectiveness of refinement in laboratories and elsewhere*
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Sources of negative experiences or affects: motivational urges and drives

• Health and survival depend on homeostatic mechanisms
• Their critical role is interactions between the internal and external environments of the body
• These interactions are active not passive
Sources of negative experiences or affects: motivational urges and drives

- Health and survival depend on homeostatic mechanisms.
- Their critical role is interactions between the internal and external environments of the body.
- These interactions are active not passive.
- They are focused on basic functions: e.g.
  - Respiratory gas exchange
  - Fluid (water/electrolyte) balance
  - Nutrient supply and utilisation
  - Thermal equilibrium
  - Responses to injury
Sources of *negative* experiences or affects: *motivational urges and drives*

- These interactions involve *purposeful behaviours* at various levels of complexity
- These behaviours are *essential for survival*
- They involve various *motivational urges and drives*
- These urges and drives represent the *subjective elements* of these *instinctual behavioural patterns*
Sources of negative experiences or affects: motivational urges and drives

- These urges and drives include:
  - Hunger for air (breathlessness)
  - Thirst
  - Hunger for specific minerals (i.e. salt hunger)
  - Hunger for energy-dense food (i.e. general hunger)
  - Pain
  - Sensations accompanying visceral functions such as micturition or defecation
  - Desire for sleep after severe deprivation
  - Avoidance of change in body core temperature
Sources of negative experiences or affects: motivational urges and drives

- Fresh insights into the neurological foundations of these urges and drives:
  - Onset
  - Intensity
  - Directedness
  - Disappearance

Full details are available from:

Here we are keeping it simple
Sources of negative experiences or affects: motivational urges and drives

• These urges and drives have two key characteristics:
  – A commanding specific sensation:
    • They often make only mild intrusions into consciousness
    • BUT, when strong, they can dominate consciousness
    • They are subjectively distinct – we do not mix them up
  – A compelling specific intention:
    • Thirst generates a compelling intention to drink, NOT eat or defecate
    • Air hunger, due to suffocation, generates a compelling intention to fight for breath
Sources of negative experiences or affects: motivational urges and drives

A striking feature of each urge and drive

• Once the motivated behaviour achieves its objective there is a precipitous decline in both the sensation and the intention:
  – Air hunger is extinguished rapidly with a few deep breaths
  – Thirst with drinking of water
  – Salt hunger with ingestion of salt
  – General hunger with the speedy consumption of food

• Brain imaging studies show neural correlates with the changes in these urges or drives
Sources of negative experiences or affects: motivational urges and drives

Brain imaging studies:

• **Intense activation** in particular cortical regions:
  – When marked *air hunger* is at its height
  – When marked *thirst* is at its height

• **Deactivation** in these cortical regions accompanies:
  – *Rapid extinction* of air hunger with *restoration of breathing*
  – *Rapid extinction* of thirst with *drinking to satiation*

• The *cortical activation and deactivation*, respectively, are linked to the *onset* and *rapid loss of conscious awareness* of these urges and drives
Sources of negative experiences or affects: motivational urges and drives

A reminder:

• These urges and drives are derived from sensory ‘scanning’ of the internal conditions of the body

Animal welfare implication

• This pattern of cortical activation/deactivation supports the view that minimisation of such urges and drives (which are –ve mental states) merely moves the associated welfare state from –ve to neutral, NOT beyond neutral to +ve
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Positive subjective experiences or affects

- Long proposed, now widely accepted that animals can also have +ve experiences
- Thus, it is likely that AW compromise may result from factors that prevent +ve experiences
- Promoting good AW thus requires BOTH the minimisation of –ve and the promotion of +ve experiences
- Such experiences are subjective, emotional and/or affective in character
Positive subjective experiences or affects

- Positive experiences include: satiety, vitality, reward, contentment, curiosity and playfulness
- Absence of such affects may be a form of welfare compromise
- Their presence may thus constitute a need in the mental domain
- In these terms, good welfare results both from an absence of –ve states and the presence of +ve states
Positive subjective experiences or affects

• Jaak Panksepp’s neuropsychological thinking and research provide strong support for this view:
  – To date, it has not been imported into animal welfare science thinking to any great extent
  – In part because of the discursive character of his writing
    • High quality, a delight to read, but lengthy and hard work
  – In part because of its neurophysiological complexities
  – In part because he attributes intentionality and emotional contents to behaviour – ideas that are only now regaining credibility
Positive subjective experiences or affects

• Thus, Panksepp’s *neuropsychological thinking and research* are not well known in animal welfare circles:
  
  – Recently I have made an attempt to correct this omission –
  
Positive subjective experiences or affects

Panksepp and colleagues have conceived of seven emotional action-orientated systems and outlined their cogent neuropsychological foundations:

- SEEKING +
- FEAR -
- RAGE-ASSERTIVENESS* -/+ (RAGE)
- BONDING* +/- (PANIC)
- CARE +
- PLAY +
- LUST +
Positive subjective experiences or affects

- SEEKING system:
  - Its *embedded emotional content* includes –
    - Compelling *exploratory urges*
    - Involving *wanting and expectancy*
    - Leading to *engaged aliveness and excitement*
  - *Behaviourally* expressed as *goal-directed, energised exploration of or interaction with the environment*
  - *Neural circuits* associated with *+ve affect or reward*
Positive subjective experiences or affects

- FEAR system:
  - *Generates* –ve affects of –
    - Anxiety
    - A sense of threat
    - Fear
  - *Behaviourally* expressed as *nervous vigilance, freezing or flight*
  - *Neural circuits for threat recognition and others for behavioural evasion of threat.*
Positive subjective experiences or affects

• RAGE-ASSERTIVENESS system (two elements):

  1. RAGE
    – Generates strongly –ve affects of –
      • Anger, rage and highly aroused urges to defeat, dominate or defend
    – Behaviourally expressed as species-typical offensive or defensive enraged attack behaviours
    – Neural circuits for rage expression, threat recognition and some involvement of the FEAR circuits
**Positive subjective experiences or affects**

- **RAGE-ASSERTIVENESS system** *(two elements):*

  2. **ASSERTIVENESS**
  
  - *Generates* +ve affects of energised, goal-directed wanting and expectancy driven by appetitive and consummatory urges
  
  - *Behaviourally* expressed as highly focused predatory stalking and attack, or focused and engaged foraging
  
  - *Neural circuits* involved are merged with those of the SEEKING system that engender a sense of reward
Positive subjective experiences or affects

• BONDING system (two facets):
  1. Drive to experience +ve affects
     – Generates a strong drive to attain and retain the comfortable and comforting +ve affects of affectionate companionship or protection
     – Behaviourally expressed through initiation of and responsiveness to species-typical prosocial or affiliative interactions
     – The circuits involve neuroactive agents such as endogenous opioids, oxytocin, vasopressin and noradrenaline, as well as circuits for detecting thermotactile and odour cues.
Positive subjective experiences or affects

- BONDING system (two facets):
  2. Drive to avoid –ve affects
    - *Generates* a strong drive to avoid *separation-induced anxiety* or *panic*, or *isolation-induced loneliness*
    - *Behaviourally* expressed through attempts to *reunite with bonded others*, or as *depressive inactivity*
    - *The circuits involve* *neuroactive agents* such as *endogenous opioids, oxytocin, vasopressin* and *noradrenaline*, as well as *circuits for detecting* *thermotactile and odour cues*. 
Positive subjective experiences or affects

- CARE, PLAY and LUST systems:
  Manifest +ve affects via:
  - Protective and empathetic maternal care
  - The joyfulness of play
  - The appetitive eroticism and orgasmic pleasures of lust
  - Behaviourally expressed in system-specific and species-typical ways
  - Neural circuits involving specific neurochemicals and neuroactive hormones that generate these particular prosocial and affiliative emotions and behaviours.
Positive subjective experiences or affects

- Promotion of +ve affective states:
  - To date, the primary rationale has been:
    - *Behaviour-based* assessments of *motivation* to satisfy perceived needs, wants or preferences
    - A key example is *environmental enrichment* initiatives
    - *Panksepp’s concepts* and their *neuropsychological support* may *strongly reinforce* the largely behavioural basis for most such initiatives taken to date.
Positive subjective experiences or affects

- **Replacement of –ve states with +ve states:**
  - **Manipulation of the FEAR system:**
    - *Anxiety, fear and nervous vigilance may be replaced by calmness and harmonious interactions with other animals and human beings*
    - By minimising visual, auditory, olfactory, environmental, handling and other cues that may engender a sense of threat
    - *Otherwise fearful animals may thereby enjoy the enlivening rewards of exploratory and appetitive behaviour generated by the SEEKING system*
Positive subjective experiences or affects

• **Replacement** of –ve states with +ve states:
  
  ▪ Manipulation of the SEEKING system:
    – *Boredom* may be replaced by the enlivening rewards of exploratory and appetitive behaviour
    – By improving the levels of **environmental complexity and variety** available for the animals
Positive subjective experiences or affects

• **Replacement** of –ve states with +ve states:
  - Manipulation of the BONDING system:
    - Loneliness, isolation, helplessness, separation distress and feelings of abandonment may be **replaced** with feelings of affectionate companionability and of being secure and protected
    - By promoting **affiliative interactions** with compatible animals and **minimising the separation** of bonded animals
Positive subjective experiences or affects

• Replacement of –ve states with +ve states:
  □Manipulation of the CARE, PLAY and LUST systems:
    – +ve prosocial and affiliative emotions could be reinforced if management practices were to be directed towards the CARE and PLAY systems and, probably limited to breeding animals, the LUST system
Positive subjective experiences or affects

• **Replacement** of –ve states with +ve states:
  
  ☐ **Manipulation** of the RAGE-ASSERTIVENESS system:
    
    – *Frustration* and *anger* may be minimised by the above initiatives
    
    – Also by continuing existing *breeding* and *culling* programmes that *target temperament*
    
    – As well as by keeping only *mutually compatible animals* together in *groups*
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Concluding remarks

- Targeting different types of pain caused by laboratory procedures and generally covers a wide range of potential –ve effects that merit direct attention.

- Defining different types of distress focused on specific additional –ve effects that also merit mitigation.

- Many of these relate to motivational urges or drives generated by the internal conditions of the body.

- BUT acceptable or good animal welfare is more than the mere absence of –ve subjective, emotional or affective states

- It also includes the presence (and promotion) of +ve states.
Concluding remarks

• Such +ve experiences may include feelings of satiety, vitality, reward, contentment, curiosity and playfulness.

• Panksepp’s concepts extend understanding of the neuropsychological foundations of the intentionality and emotional contents of particular behaviours.

• They thereby also provide a functional rationale, reinforcing the behavioural one, for the replacement of –ve with +ve affective states.
Concluding remarks

• Finally, let us review the list of subjective, emotional or affective experiences we now need to consider when evaluating the potential impacts of laboratory procedures and other management approaches on animals:

  – **Negative states**, which our actions may *cause*, include:
    - Many types of pain, thirst, hunger, weakness, debility, breathlessness, nausea, sickness, anxiety, fear, nervous vigilance, boredom, loneliness, isolation, helplessness, frustration and anger, and other unspecified forms of distress

  – **Positive states** that our actions may *compromise*, include:
    - satiety, appetitive and consummatory satisfaction, reward, goal-directed engagement, curiosity, vitality, playfulness, calmness, contentment, affectionate companionability, and feelings of security
Concluding remarks

This much longer list might reasonably be expected to:

- Engender a more comprehensive awareness of mitigation possibilities and to enhance caring and empathetic attitudes towards animals

- Among RTT personnel, members of Animal Ethics Committees or Animal Care and Use Committees, farmers, veterinarian and others.
Thank you

Q & A