Animal Welfare Science and Bioethics Centre

Massey University

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OiE **Collaborating Centre for Animal Welfare Science and Bioethical Analysis:**
Founding Partner

http://animalwelfare.massey.ac.nz

Animal Emotions, Behaviour and the Promotion of Positive Welfare States*

Professor David J Mellor

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*Mellor (2012).
New Zealand Veterinary Journal – in press

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Areas considered

- **Introduction**
- **Motivational urges and drives**
- **Emotional action-orientated systems**
- **Implications for welfare codes**
- **Concluding remarks**

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Introduction

- **Ideas about animal welfare have evolved over 30 years**
- **Early ideas focused on:**
  - Biological function and restoring imbalances or disturbances
  - For example, dehydration, energy shortage, injury
  - Minimising –ve experiences – e.g. thirst, hunger, pain

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Introduction

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  - Minimising –ve experiences – e.g. thirst, hunger, pain
- **Affective states were then given increasing attention:**
  - Largely based on behavioural observations
  - Focus still on minimising –ve experiences
  - For example, anxiety, fear, loneliness, boredom

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Introduction

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- **Affective states were then given increasing attention:**
  - Largely based on behavioural observations
  - Focus still on minimising –ve experiences
  - For example, anxiety, fear, loneliness, boredom
- **Now, AW is equivalent to what the animal experiences**

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Introduction

- **AW is a state within an animal**
- **It is the integrated outcome of:**
  - *Internally generated* sensory inputs
  - *Externally generated* sensory inputs
  - Giving rise to *subjective, emotional or affective states*
  - *Experienced consciously*

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Introduction

- **AW is a state within an animal**
- **It is the integrated outcome of:**
  - *Internally generated* sensory inputs
  - *Externally generated* sensory inputs
  - Giving rise to *subjective, emotional or affective states*
  - *Experienced consciously*
- **Still, there is a strong emphasis on –ve states**
  - **Thirst, hunger, pain, anxiety, fear, loneliness, boredom**

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Introduction

- **It is accepted that:**
  - **Such experiences cannot be measured directly**
  - **BUT the biological states or external situations that give rise to them can be *managed***
  - **E.g. manage water/food supply, avoid or treat injury, minimise emotional threats, provide company or variety**

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Introduction

- It is accepted that:
  - Such experiences cannot be measured directly
  - BUT the biological states or external situations that give rise to them can be *managed*
  - E.g. manage water/food supply, avoid or treat injury, minimise emotional threats, provide company or variety

- Also, there is now an increasing emphasis:
  - On *promoting* +ve experiences
  - While *continuing to minimise* –ve experiences

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Introduction

- These +ve states include:
  - Pleasure, comfort, contentment, curiosity, playfulness

- BUT 'functionalists' are uneasy about such affective states:
  - Cannot be monitored easily with biological function indices
  - Rely heavily on behavioural indices that have ill-defined functional (neurophysiological) foundations
  - Therefore appear to 'functionalists' to be only marginally credibility

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Introduction

A major purpose here:

Is to show that there is an increasingly secure scientific understanding of the neurological foundations of affective states and the motivational drives that energise and direct their associated behaviours

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Introduction

A major purpose here:

Is to show that there is an increasingly secure scientific understanding of the neurological foundations of affective states and the motivational drives that energise and direct their associated behaviours

In other words:

To functionally validate the use of selected behaviours as indices of the emotional contents of +ve affective states such as pleasure, comfort, contentment, curiosity and playfulness

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Introduction

RELAX

This talk will NOT be an *obscurantist discourse* on complex *neurophysiology* or *neuropsychology*

BUT

There WILL be *some brief and very easily understood* descriptions of relevant neurological mechanisms

[More detail is provided in my paper]

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Introduction

Another major purpose

Is to show:

That *minimising –ve experiences* can at best produce *neutral welfare states*

And

That by *refocusing our understanding* we can *replace* nett –ve welfare states with +ve states

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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**

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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**

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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*

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Motivational urges and drives

- **These *urges and drives* include*:***
  - Hunger for air (breathlessness)
  - Thirst
  - Hunger for specific minerals
  - Hunger for energy-dense food
  - Pain
  - Sensations accompanying visceral functions such as micturition or defecation
  - Desire for sleep after severe deprivation
  - Avoidance of change in body core temperature

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Motivational urges and drives

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

Full details are available from:
Denton et al (2009). *Consciousness and Cognition 18,* 500-514

Here we are keeping it simple

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Motivational urges and drives

- **These urges and drives have *two key characteristics*:**
  - A *commanding specific <u>sensation</u>*:
    - 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 <u>intention</u>*:
    - *Thirst* generates a compelling intention to *drink*, NOT eat or defecate
    - *Air hunger,* due to suffocation, generates a compelling intention to *fight for breath*

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Motivational urges and drives

<u>A striking feature </u>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**

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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 <u>conscious awareness</u> of these urges and drives

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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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Emotional action-orientated systems

A further reminder:

- 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

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Emotional action-orientated systems

Motivational urges and drives – yet another reminder:

- These arise from *sensory 'scanning'* of the *internal conditions* of the body via *'interoreceptors'*

Emotional or affective states:

- These arise from *sensory 'scanning'* of the *external circumstances* of the body
- The sensory receptors are *'exteroreceptors'* such as those in the *eyes, ears, nose and skin*

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Emotional action-orientated systems

Emotional or affective states

- **These include:**
  - anxiety, depression, disgust, fear, rage   *–ve states*
  - affection, contentment, happiness, playfulness   *+ve states*

- **Brain excitation and imaging studies (human/animal):**
  - An *established neural circuitry* is involved
  - Each emotion engages brain regions in *distinctive patterns of activation and deactivation*

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Emotional action-orientated systems

- **Jaak Panksepp's** *neuropsychological thinking and research* **are important here:**

    - To date, they have *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

    Panksepp (2005). *Consciousness and Cognition 14, 30-80*

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Emotional action-orientated systems

- **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
    - I have distilled Panksepp's key insights and the supporting evidence into a few easily understood paragraphs
    - These give more detail than I shall provide here

    Mellor DJ (2012). **Animal emotions, behaviour and the promotion of positive welfare states.** *New Zealand Veterinary Journal* (in press)

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Emotional action-orientated systems

- **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   +

    The names are capitalised purposely

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Emotional action-orientated systems

- **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* include those associated with *+ve affect or reward*

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Emotional action-orientated systems

- **FEAR system:**
  - *Generates* –ve affects of
    - **Anxiety**
    - **A sense of threat**
    - **Fear**
  - *Behaviourally* expressed as *nervous vigilance, freezing or flight*

  - *Neural circuits* include those for *threat recognition* and others for *behavioural evasion of threat*.

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Emotional action-orientated systems

- **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* include those for *rage expression* and *threat recognition* with some involvement of the *FEAR circuits*

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Emotional action-orientated systems

- **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*

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Emotional action-orientated systems

- **BONDING** system (*two elements*):

  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*

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Emotional action-orientated systems

- **BONDING system (*two elements*):**
- **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, when unsuccessful, 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*

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Emotional action-orientated systems

- **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* involve specific *neurochemicals* and *neuroactive hormones* that generate these particular *prosocial and affiliative emotions and behaviour*s

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Implications for welfare codes

- *Promotion* of +ve affective states:

  To date, the primary rationale for this 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

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Implications for welfare codes

- *Replacement* of –ve states with +ve states:

  Manipulation of the FEAR system:
  - *Anxiety*, *fear* and *nervous vigilance* may be <u>*replaced*</u> 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*

  - *Also, otherwise fearful animals* may thereby enjoy the *enlivening rewards* of exploratory and appetitive behaviour generated by the SEEKING system

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Implications for welfare codes

- *Replacement* of –ve states with +ve states:

  Manipulation of the SEEKING system:
  - *Boredom* may be <u>*replaced*</u> by the *enlivening rewards* of exploratory and appetitive behaviour

  - By improving the levels of *environmental complexity* and *variety* available for the animals

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Implications for welfare codes

- *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 (including human beings) and *minimising the separation* of bonded animals

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Implications for welfare codes

- *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

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Implications for welfare codes

- *Replacement* of –ve states with +ve states:

  Manipulation of the RAGE-ASSERTIVENESS system:
  - *Frustration* and *anger* may be minimised by all of the above initiatives

  - Also by a continuation of existing *breeding* and *culling* programmes that *target temperament*

  - Also by keeping only *mutually compatible animals* together in *groups*

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Concluding remarks

- To date, our approach to *improving animal welfare* has been largely through activities designed to *reduce –ve subjective, emotional or affective states*.

- We now have an improved understanding of the *characteristics and neurological foundations of internally generated motivational urges and drives*, including air hunger, breathlessness, thirst, salt hunger and general hunger.

- This understanding supports the view that *minimising –ve experiences* can at best produce *neutral welfare states*.

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Concluding remarks

- 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*.

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

- They are generated, in part, by *sensory 'scanning' of the external circumstances of the animals*.

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Concluding remarks

- **Panksepp's concepts extend understanding of the *neuropsychological foundations* of the *intentionality and emotional contents* of particular behaviours.**

- **They include his detailed accounts of the seven *emotional action-orientated systems* of SEEKING, FEAR, RAGE-ASSERTIVENESS, BONDING, CARE, PLAY and LUST.**

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

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Concluding remarks

We may therefore expect that the *rationale that animal welfare improvement* should be based on *promoting +ve states, while still minimising –ve states*, will now receive a boost

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Concluding remarks

It is instructive to list what those +ve and –ve experiences might now be considered to include:

– *Positive experiences*
- satiety, appetitive and consummatory satisfaction, reward, goal-directed engagement, curiosity, vitality, playfulness, calmness, contentment, affectionate companionability, and feelings of security

– *Negative experiences*
- Many types of pain, thirst, hunger, weakness, debility, breathlessness, nausea, sickness, anxiety, fear, nervous vigilance, boredom, loneliness, isolation, helplessness, frustration and anger, and other as yet unspecified forms of distress

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Concluding remarks

What may those +ve and –ve experiences include?

– *Positive experiences* may include:
- satiety, appetitive and consummatory satisfaction, reward, goal-directed engagement, curiosity, vitality, playfulness, calmness, contentment, affectionate companionability, and feelings of security

– *Negative experiences* may 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 as yet unspecified forms of distress

This is a much wider focus than has been usual to date

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Thank you