Cognitive processes involved in the development of animal stress and welfare

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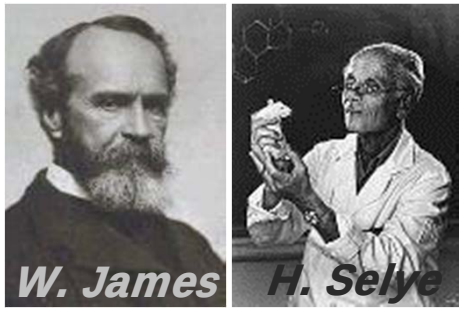
Stress, welfare and… emotions



✓Animal welfare refers to pioneer stress-studies

✓Animal welfare embraces - physical well-being
- mental well-being

↳ Farm animals are **sentient beings,** able to feel emotions
(EU Treaty of Amsterdam, 1997)

↳ Emotions are transient adaptive processes from which more persistent affective states, *i.e.* stress and welfare, develop

But, researches on animal welfare have often used indicators of stress without relating these indicators to emotions
(Dawkins, 2001; Dantzer, 2002)

What do we know about emotions in farm animals?

- ✓ What emotions are experienced by the various farm animal species remains unclear
  - ↳ Emotions have been considered for a long time out of the scope of animal sciences
  - ↳ The existence of emotional states common to both humans and animals is not well accepted by the scientific community

- ✓ A growing interest to study emotions in animals with the emergence of affective neurosciences

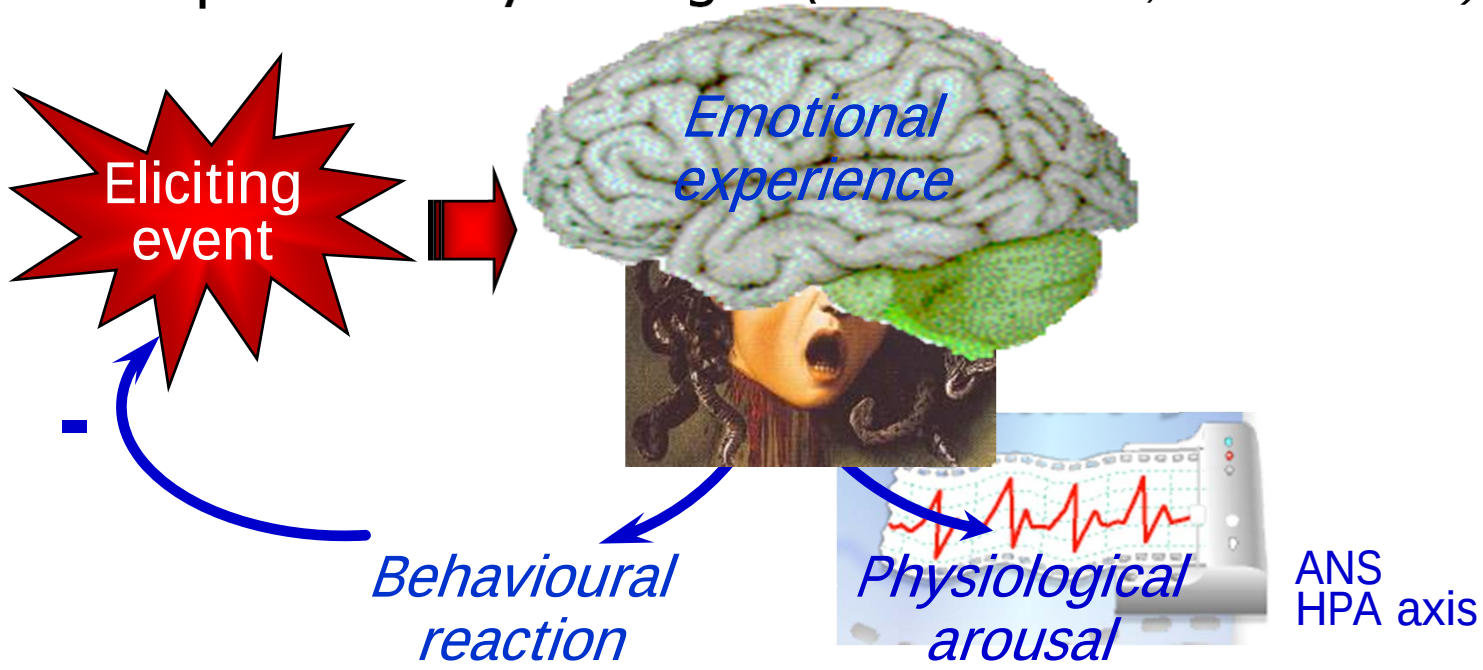
Panksepp, 1998
Damasio, 2000
Berridge, 2003

→ **It is time to consider emotions in farm animals as a scientific topic**

Assessing emotions: a psychological approach

Emotion

A brief affective response to events, associated with specific body changes *(Leventhal 1984; Dantzer 1986)*



→ **The emotional experience**
- is not directly accessible,
- can only be inferred from reactions

Assessing emotions: limits of the classic ethology

Behavioural and physiological reactions are the only indicators of emotional experiences in animals (no verbal language)

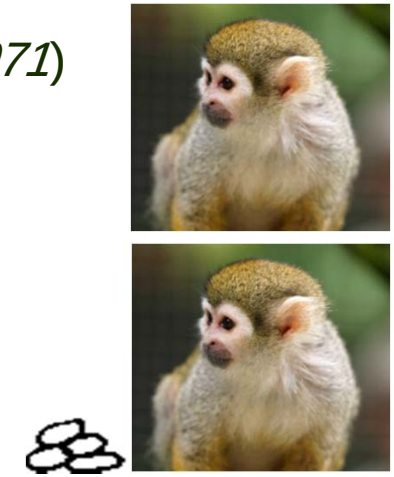
→ **New approaches have to be developed to better relate animals reactions to their own emotional experiences**

Assessing emotions: relevance of cognitive approaches

✓Emotions
- no longer considered as pre-programmed reactions,
- but rather as the end-product of an **evaluative process**

✓A pioneer experiment (*Mason, 1971*)

Monkey consuming food



Observers deprived of food

+ non-nutritive pellets =

Cortisol in saliva ↗

→ Stress depends on the way the animal perceives its world

→ Stress refers to emotions that imply a subjective perception of a situation → **a cognitive evaluative process**

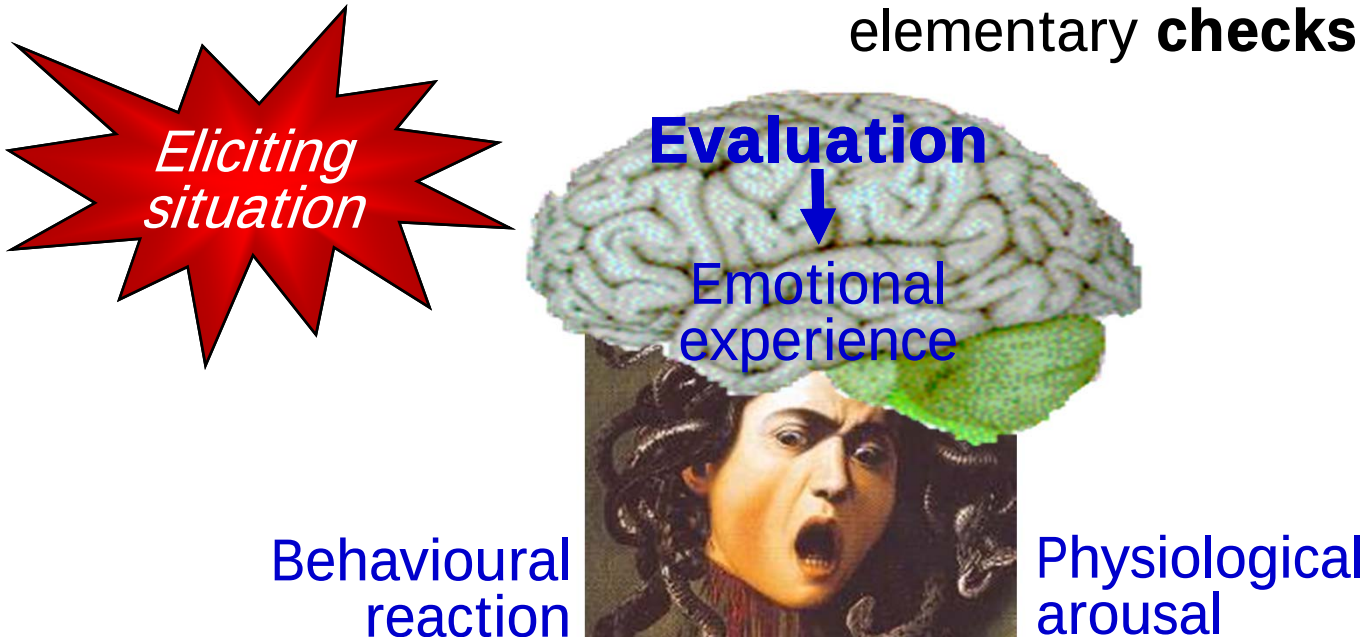
Cognitive psychology

Appraisal theories *(Lazarus, 1993)*

An emotion is triggered by the **evaluation** of the situation

A pragmatic framework *(Scherer, 1999)*

1. The evaluation depends on a limited number of elementary **checks**



- Suddenness
- Familiarity
- Predictability
- Pleasantness +/-
- Expectation
- Controllability
- Social norms

2. The outcome of the evaluation, i.e. the **combination** of these checks, determines the nature of the emotion

Questions addressed

1. Are the elementary evaluative checks (i.e. suddenness, familiarity...) identified in humans relevant for animals?
2. Can the nature of the emotions (i.e. fear, anger...) that animals experience be assessed according to the combination of elementary checks involved?
3. Can we get access to positive emotions in animals?
4. How can we assess longer lasting affective states (i.e. from emotions to welfare)?

Suddenness and unfamiliarity

Experimental paradigm

Lamb eating concentrate

A scarf appearing behind the trough

Characteristics of the scarf: familiar

Speed of appearance: slow rapid slow

control **sudden** **unfamiliar**

Results

	Behaviour	Heart rate
Sudden	**Startle**	
Unfamiliar	**Orienting behaviour**	

Désiré et al., 2004

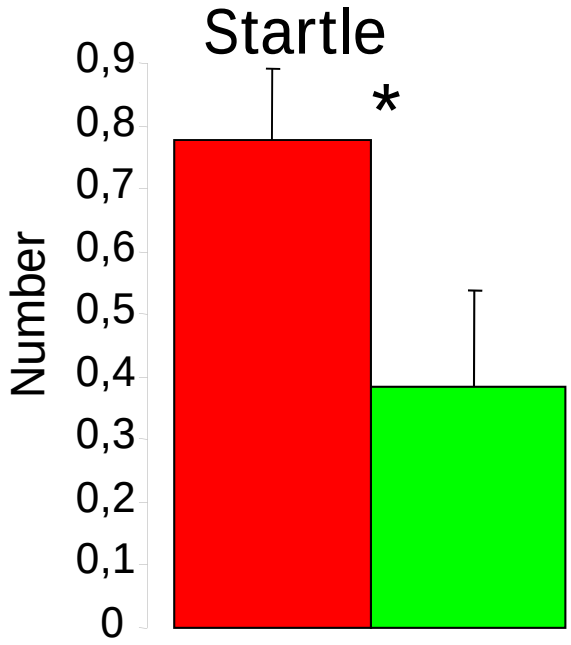
→ Suddenness induces a startle response and a tachycardia

→ Unfamiliarity induces an orientation and a transient increase in HR Variability (i.e. vagal tone)

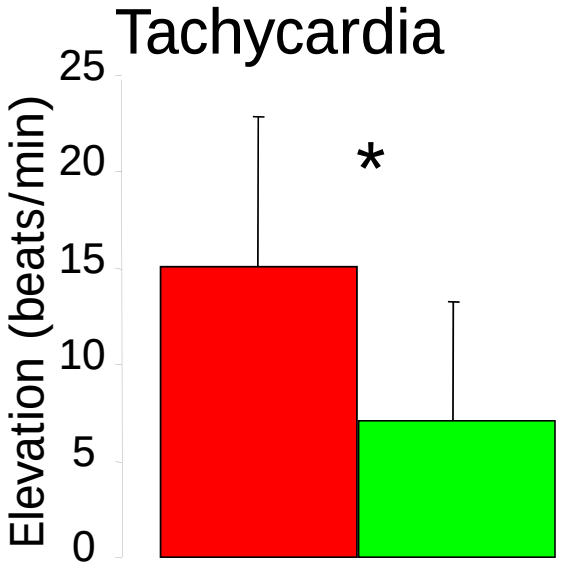
Predictability

10 food deliveries
with 5 deliveries followed by a sudden event

The sudden event occurred: at random signalled



(*: p<0,05)



Greiveldinger et al., 2007

→ Lambs are able to predict an event appearance when it is preceded by a signal

→ The predictability of a sudden event reduces its emotional responses to suddenness

Expectations

Experimental paradigm

Step 1. Lambs trained to pass the muzzle through a beam to obtain a large quantity of food reward

Step 2. Switch to a smaller amount of reward → negative contrast

Greiveldinger et al., 2010

Results

Behaviour - Increased contacts with the conditioning device

- Increased locomotion

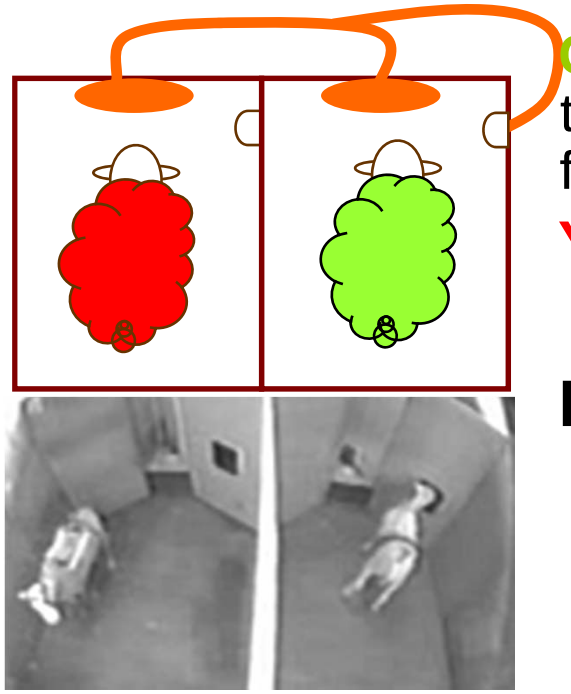
Heart rate - Tachycardia

- Low HR variability (↘RMSSD)

→ Lambs are able to form expectations

→ Discrepancy between lambs' expectations and the amount of food received (i.e. negative contrast) induces behavioural agitation and tachycardia

Controllability



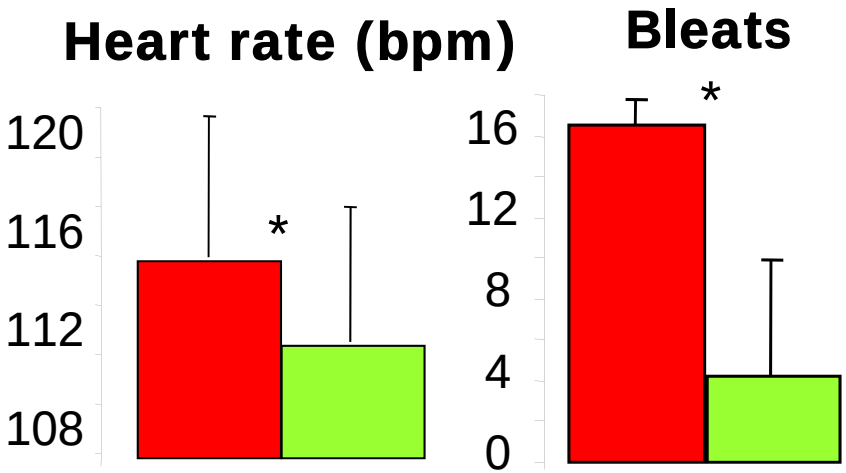
Greiveldinger et al., 2009

Experimental paradigm

Controlling lambs. Trained to pass the muzzle through a beam to remove a grid preventing access to food

Yoked lambs. No possibility to control feeding access

Results



→ The possibility to control reduces emotional responses

Reference to social norms

Experimental paradigm

- 10 food deliveries
  with 5 deliveries followed by a sudden event
- Each lamb was tested with a partner in an adjacent room

Results	With a Subordinate	With a Dominant
Behaviour	Walk back + agitation	Look at the partner
Heart rate		
Heart rate variability		High variability ↗RMSSD

→ **Overt reactions** → **Internal reactions**

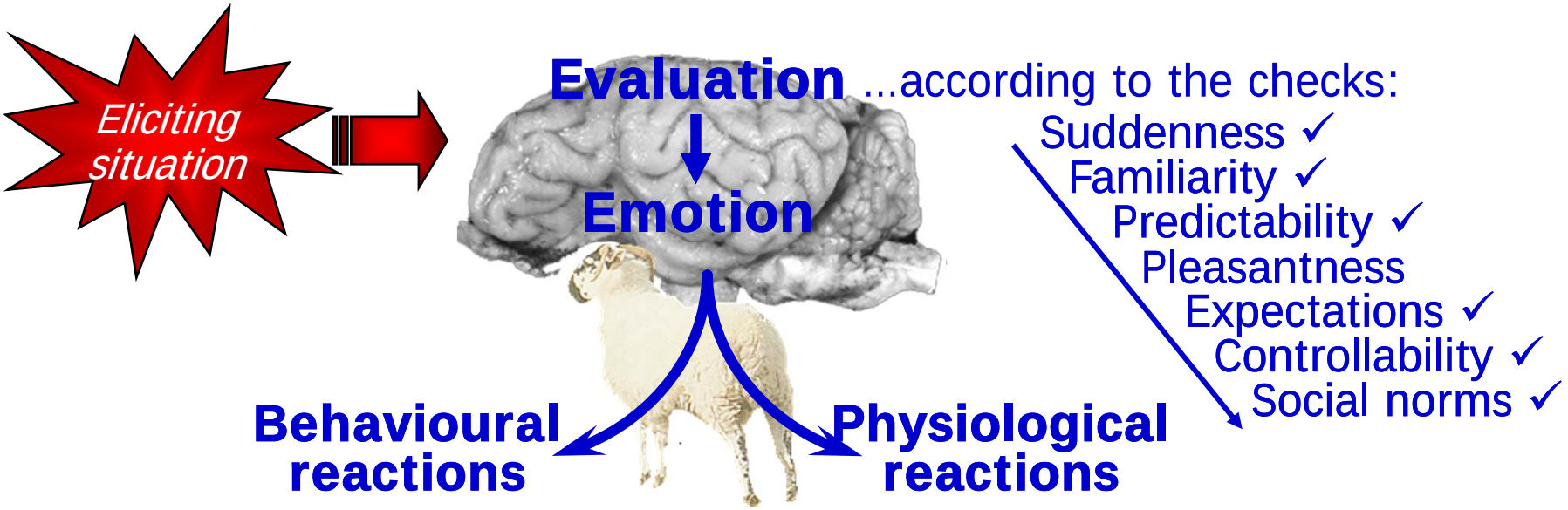
→ In presence of a dominant, the lambs were less reactive to the sudden event but looked longer at the partner

↳ The relation with other members of the group affect emotional responses

The emotional responses of sheep
- are more than simple reflexes
- result from evaluative processes

Lambs are capable of complex cognitive appraisals:

→ The elementary checks are relevant for animals



→ The framework of appraisal theory has renewed the scientific approaches of emotions in animals

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Suddenness X Familiarity

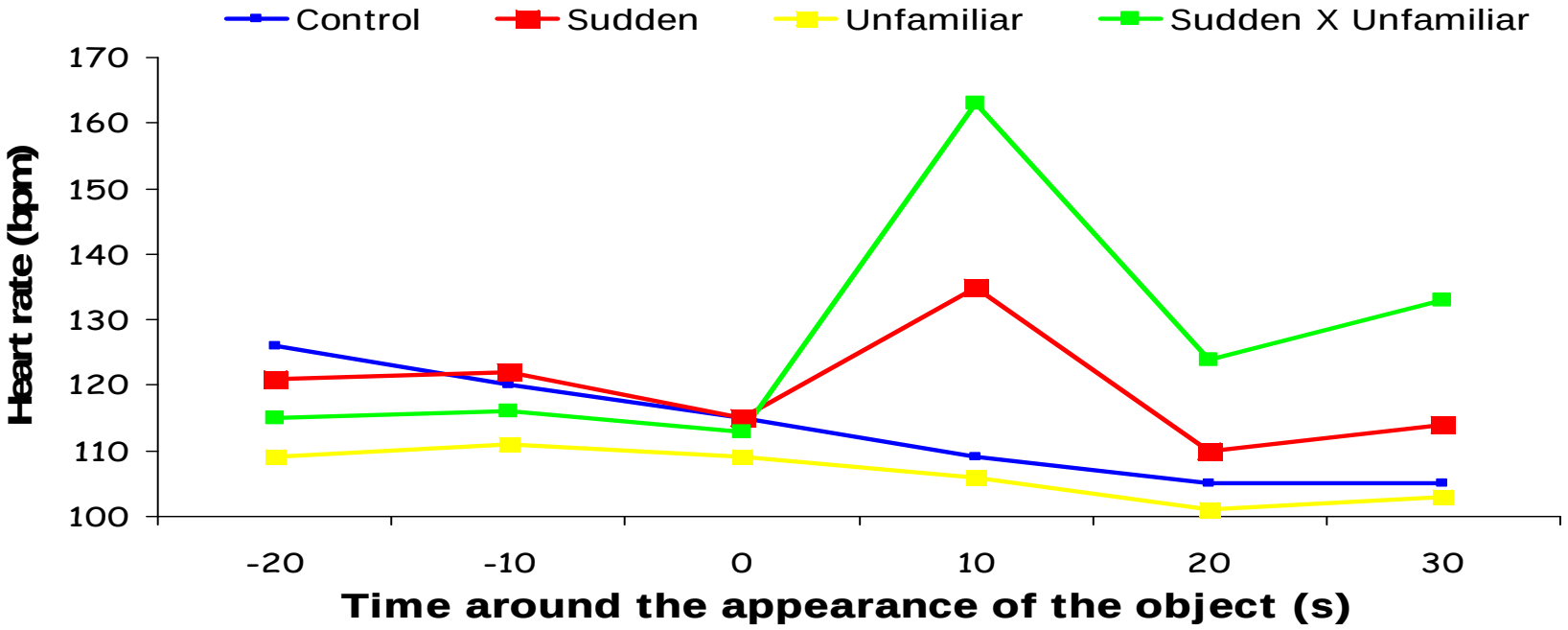
Experimental design

Appearance of a scarf:

familiar: slow → **control**; rapid → **sudden**

unfamiliar: slow → **unfamiliar**; rapid → **unfamiliar x sudden**

Désiré et al., 2006



→ Synergy effect: unfamiliarity reinforces the cardiac increase to suddenness

1. The elementary checks that are identified in humans are relevant for our animals

2. The combination of evaluative checks would be the basis to decrypt emotions in animals

   - ✓ The **nature of the emotions** that sheep experience can be better approached according to the combination of the elementary checks
   - ✓ Our framework allows a **comparative approach** to assess the range of emotions that different animals are able to experience according to their cognitive abilities:
     - ➢ intra-species comparison (age, breed, sex)
     - ➢ inter-species comparison

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- Current animal welfare research has usually focused on a **“not-so-bad” welfare** *(Dawkins, 2006)*

  ⇔ reducing negative feelings
  without attempt to induce positive feelings

- Feelings are not exclusively negative !
  The well-being of an animal is a combination of negative and **positive** emotions (*Fraser, 1995; Duncan, 2005*)

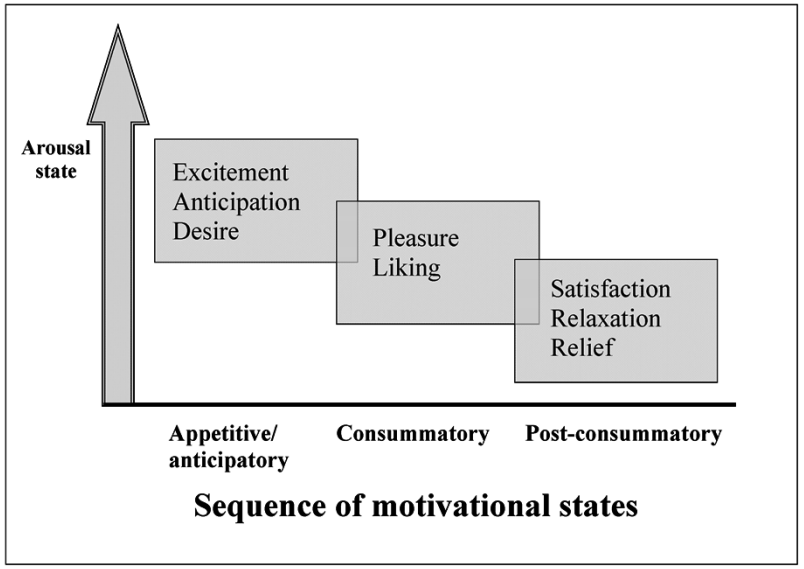
→ What do we know about positive emotions in animals?

Expressions of positive emotions

- The appetitive phase as a main source of positive emotions

  → **Pleasure**: the perspective to access to an expected pleasant event

  (Reward cycle: Keeling et al., 2010)

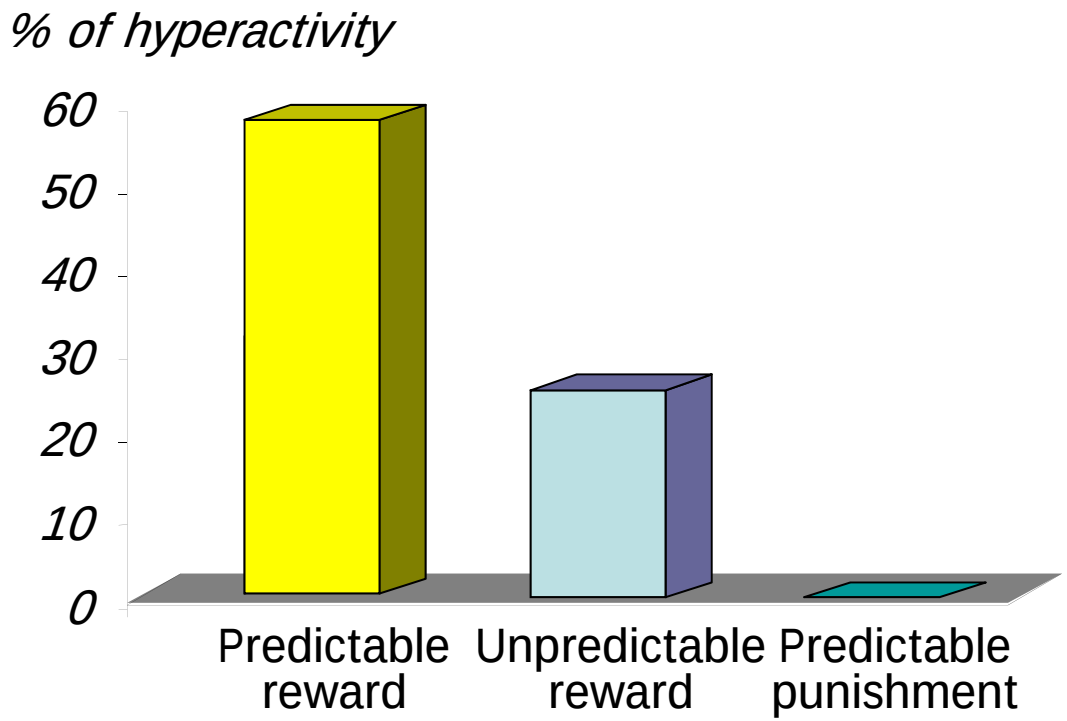


- The conceptual framework based on cognitive processes provides an objective assessment of positive emotions
  (Boissy et al., 2007)

  → Three ways to elicit positive experiences in animals:

  - **Anticipation of a reward**
  - **Controlling** deliveries of a reward
  - **Positive discrepancy from expectation**
    (↔ receiving more than the expected reward)

Anticipation of a reward

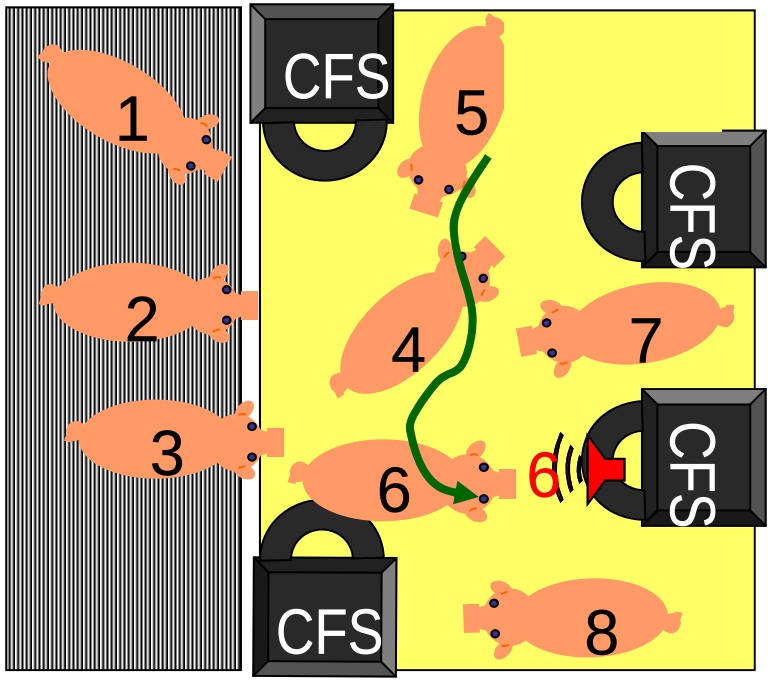


Moe et al., 2005

→ Predicting a reward increases motor activity (*i.e., anticipatory hyperactivity*) in fox, dog, rodent, poultry, sheep...

Anticipation of a reward & Controlling deliveries of a reward

Call Feeding System (CFS) : Pigs are trained to perform a task to get food + a noise signals the availability of food



Pigs housed with CFS
vs.
Pigs conventionally fed

Kalbe and Puppe, 2010

→ CFS increases levels of endogenous opioid which underlie reward-related behaviours

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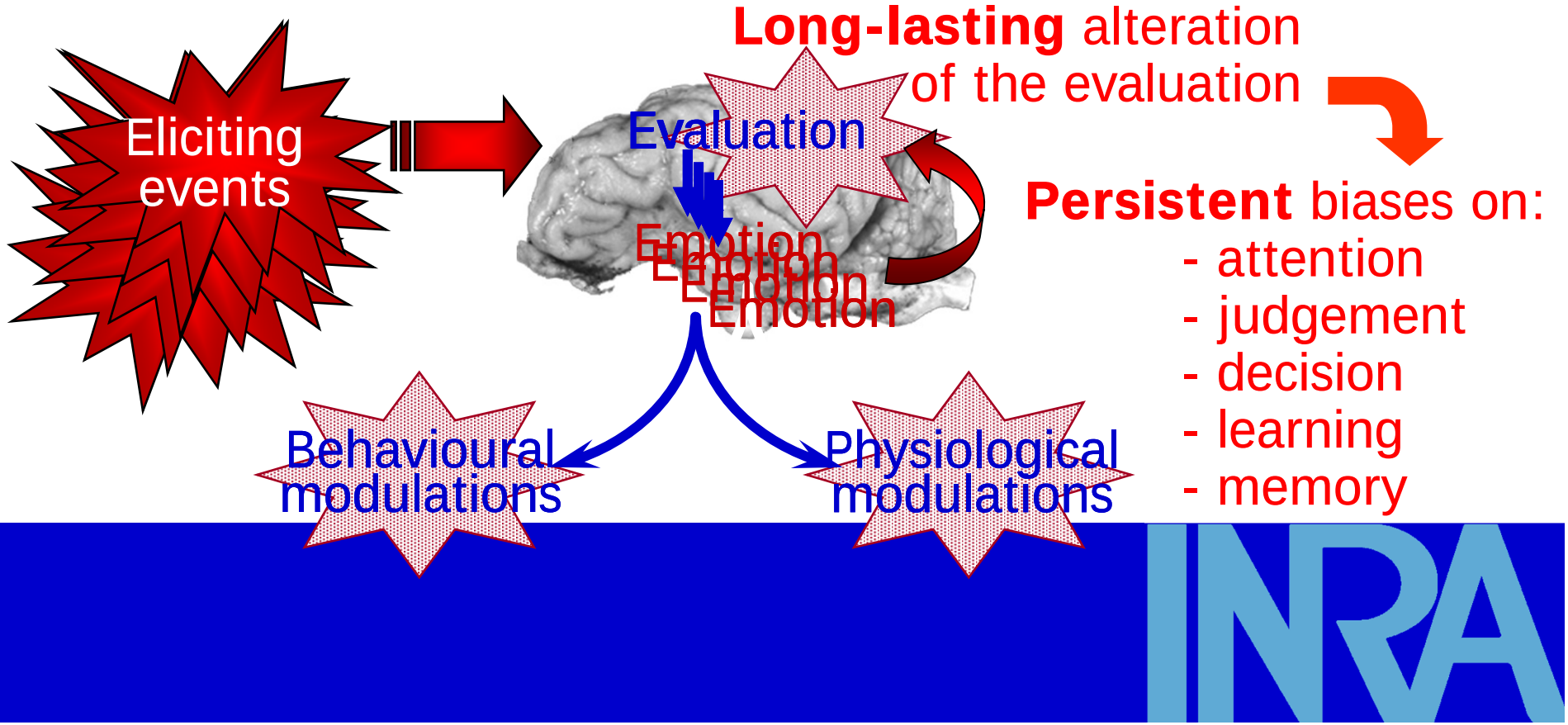
EAAP Bratislava, August 30th 2012

How can we assess longer lasting affective states?

(from emotions to welfare)

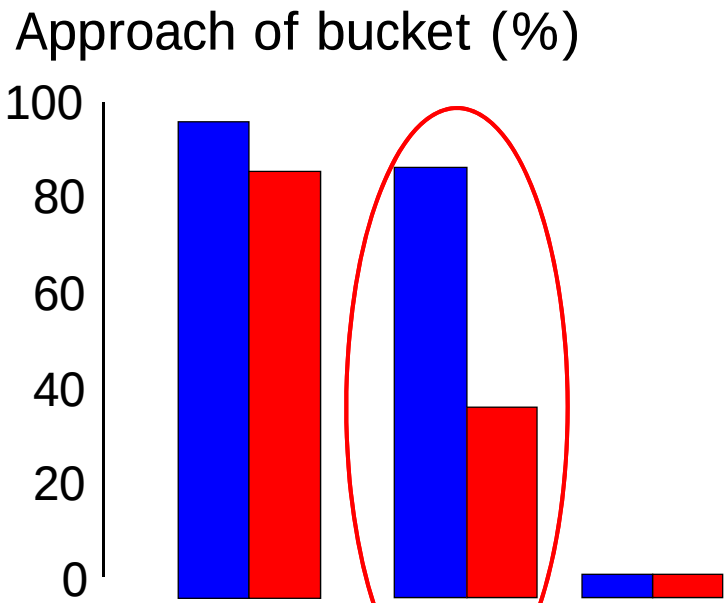
Accumulation of emotions induces an affective state that alters the cognitive functions in a long-lasting manner



Stress induces judgement biases

Paradigm:

- Step 1. Training session of go/no-go
- Step 2. Repeated unpredictable stress vs. no stress during 1 month
- Step 3. Re-exposure - to the operant task
  - to an intermediate position between the 2 learnt positions



Results:

Stressed sheep approach less the **ambiguous bucket**

Control
Stressed sheep

Doyle et al., 2011

→ An extensive experience of unpredictable disturbing events
- reduces the expectation of positive events
- strengthens the negative interpretation of ambiguous events

From emotions to long-lasting affective states

→ The conceptual framework of appraisal theories can help to understand the development of long-lasting affective states in animals

Accumulation of negative emotional experiences

⬇

Downward spiral leading to a persistent overestimation of negative outcomes, *i.e.* **pessimistic mood**

Accumulation of positive emotional experiences

⬇

Upward spiral leading to a persistent overestimation of positive outcomes, *i.e.* **optimistic mood**

Farming practices eliciting positive emotions

✓ Developing **cognitive enrichment**

By using positive anticipations, control of rewards and positive contrasts

→ *an enrichment from the animal point of view*

✓ Highlighting the link between **positive experiences** and **the alleviation of negative effects of stress**

Rats which are regularly allowed to anticipate rewards recover from chronic social stress *(van der Harst et al., 2005)*

→ *positive experiences help to cope with stressful events*

→ Promoting farming practices that elicit positive emotional experiences in animal can

- reduce its susceptibility to stress (and even diseases ?)
- counteract the effects of past stressful experiences

→ Contributes to good welfare and maybe good health

Thanks to our PhD students:

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Thank you for your attention

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