What can facial behaviour reveal about animal welfare?

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What is animal welfare? Why is it important?

A continuum from very poor to very good with a multitude of potential affecting ‘domains’

e.g. Mellor & Beausoleil 2016
Avoidance of long term negative affect is a key feature of good animal welfare
How is animal welfare measured?

Behaviour: Quantative or qualitative

Psychological measures: Cognitive bias, cognitive impairments

Clinical measures: Health, disease, immune function

Physiological measure: HPA axis response

Production measures: Growth, reproduction rates

Lack some measures possible in humans (e.g. verbal self report)
Why another tool?

Lack of causal specificity
Lack of temporal specificity
Lack of valence specificity
Why have facial expressions?

Facial muscle structure conserved across most mammals and may act in several ways:

- Mechanistic function
- Communicate intention / impending action
- Reflect affective state

All 3 useful from an animal welfare point of view.
Observation bias in humans

Human expertise in face perception
Observation bias in humans

Pain detection task: Human observers prefer to look at faces (observations/1min) (Leach et al. 2011)
Pain management = key concept for welfare

Requires reliable pain identification

Humans have a ‘pain face’

Emerging evidence in a range of other mammals demonstrates facial changes with pain states

Mice, rats, rabbits, horses, sheep...

Langford et al. 2010
In humans, eye aperture increases with fear and surprise (Williams 2002; Waller et al. 2008a).

The muscle responsible for this is conserved across most species (Spencer & Porter 2006).

Widened eyes = increased visual field = greater sensory intake = improved vigilance (Susskind et al. 2008).
Facial expressions and affective states

In animals, eye aperture & eye white:

• Increases in aversive situations (e.g. social isolation, catheter placement)

• Is -ve correlated with cardiac measures of ParaSymNS activation

• Is reduced by sedatives / analgesia / anxiolytics

(Light et al. 1993; Sandem et al. 2002; 2004; 2006; Reefman et al. 2009; 2010)
Facial movements and affective states

Reduced eye aperture can indicate either:

Negative affect
(anger in humans, counterpart in animals)

Positive affect
(contentment in humans, play context or allogroom)
Communication and welfare

Communicative activities may be useful for welfare monitoring.

Many communicative states have prototypical facial configurations.

Appeasement / affiliation
Dominance / aggression
Play
Sexual motivation (e.g. flehmen)

(Fedderson-Petersen 1991; Preuschoft & van Hooff 1997; Rooney 2001; de Waal 2003; Waller and Dunbar 2005; Honess and Marin 2006; Waller et al. 2008; Shariff & Tracy 2011)
Abnormal facial behaviours

Stereotypies – particularly of the oral-nasal region
e.g. bar biting, lip snapping, lip licking, tongue flicking

Displacement activities - often also mouth based.
Yawning, chewing, mouth twisting
Effective pain assessment tools based on bottom-up coding:

- Mice
- Rats
- Rabbits
- Horses
- Cats

Measurement tools: Grimace scales

(Langford et al. 2010; Sotocinal et al. 2011; Leach et al. 2012; Dalla Costa et al. 2014; Holden et al. 2014)
Measurement tools: FACS

Anatomically-based system for coding muscle movement

Human FACS *(Ekman and Friesen 1978)*

MaqFACS *(Parr et al. 2010 (below); Waller et al. 2008)*

ChimpFACS *(Parr et al. 2007)*

Horse FACS *(Wathan et al. 2015)*
MaqFACS (has already been developed in rhesus macaques (*Macaca mulatta*)

Neutral  AU18i – true pucker  AU18ii-outer pucker & AU1+2
Fig 8. Direction and area of AUH13, nostril lift. The picture on the left shows the neutral face, the picture on the right shows the face with a mild action of AUH13 applied. The arrow illustrates the location and direction of movement.

‘Equi-FACS’: Wathan et al. 2015
Figure 2. Examples of the prototypical configuration for chimpanzee facial expressions identified using the discriminant function analysis. Photographs are courtesy of the Living Links Center, Emory University (taken by F.B.M. de Waal or Lisa A. Parr).
When is it likely to be most useful?

1. The species of interest has sufficient muscular structure for facial mobility

2. Facial changes must be observable (direct observation, still photographs, videos)

3. Different affective states must be sufficiently differentiated or contribute to interpretation of gross level behaviour

4. The facial change is an honest signal of internal condition

5. Facial movements for production of vocalisations accounted for
Lunch time!