

Eye and muzzle temperatures measured using infrared thermography to assess sheep stress during shearing and foot trimming

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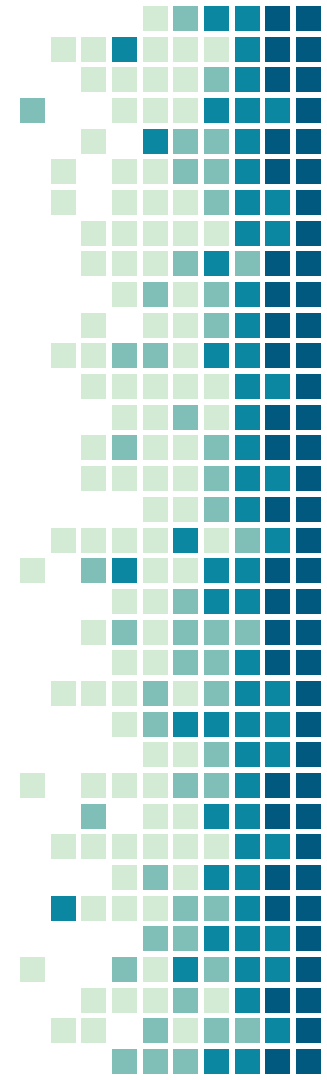
Thermography: what is it?

Heat



Thermal Image

Electronic signal




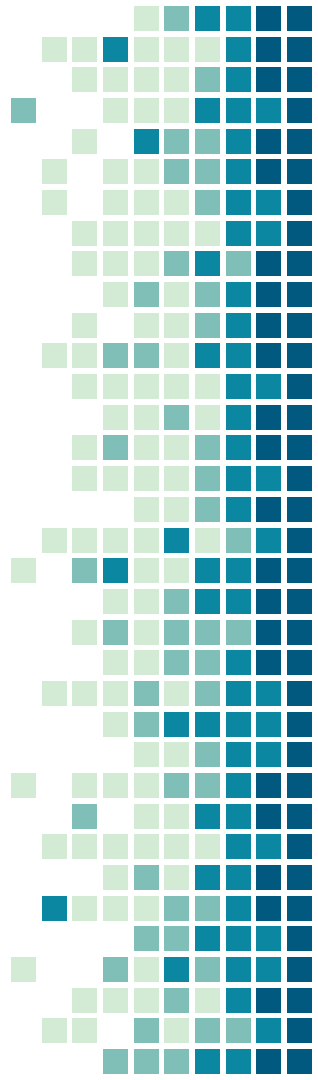
Thermography: potential applications?

- Measurement of body and eye temperature during management procedures, handling, transport and slaughter.
- Portability ✓
- Remote reading of temperature: no physical contact ✓
- Accuracy of temperature measurement ✓



The idea is...

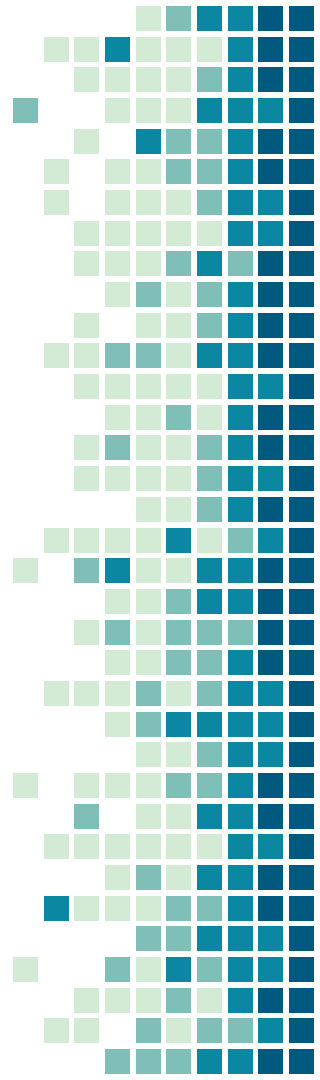
- Using thermography to detect small changes in eye temperature that occur as a product of stressful situations.
- Stressors: shearing and foot-trimming. 



Methodology

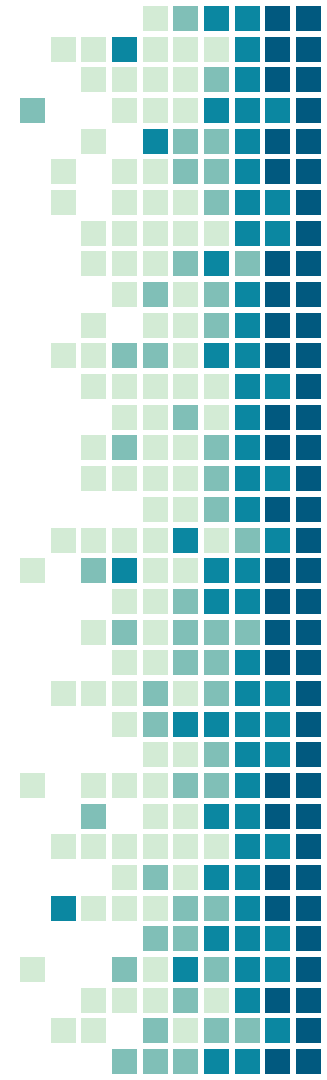
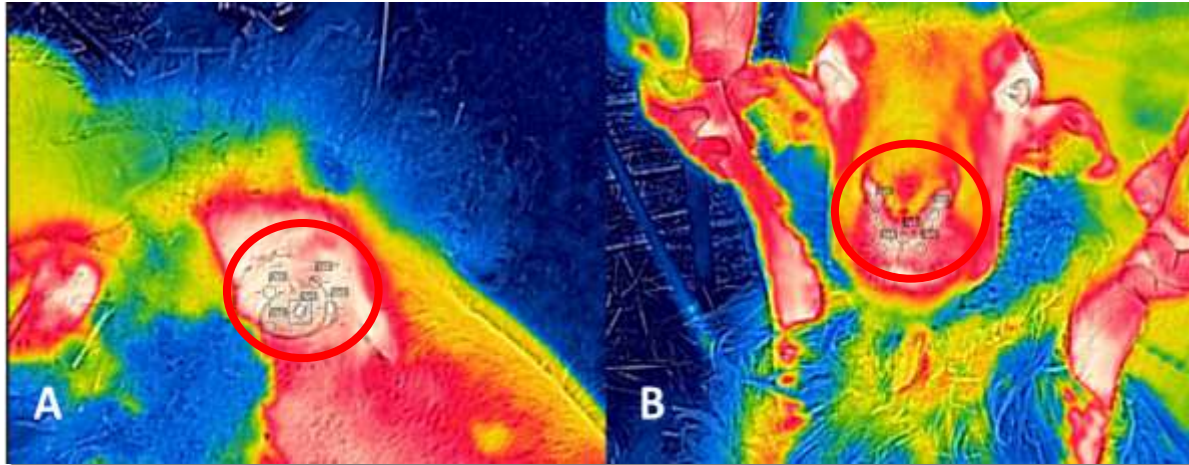
- 89 ewes
 - 55 Churra da Terra Quente (CTQ)
 - 34 Ile-de-France (IF)

- Duration: 3 days (July 2016)



Methodology

- An infrared camera FLIR F4 (FLIR Systems AB, Sweden) was used to collect thermograms



Results

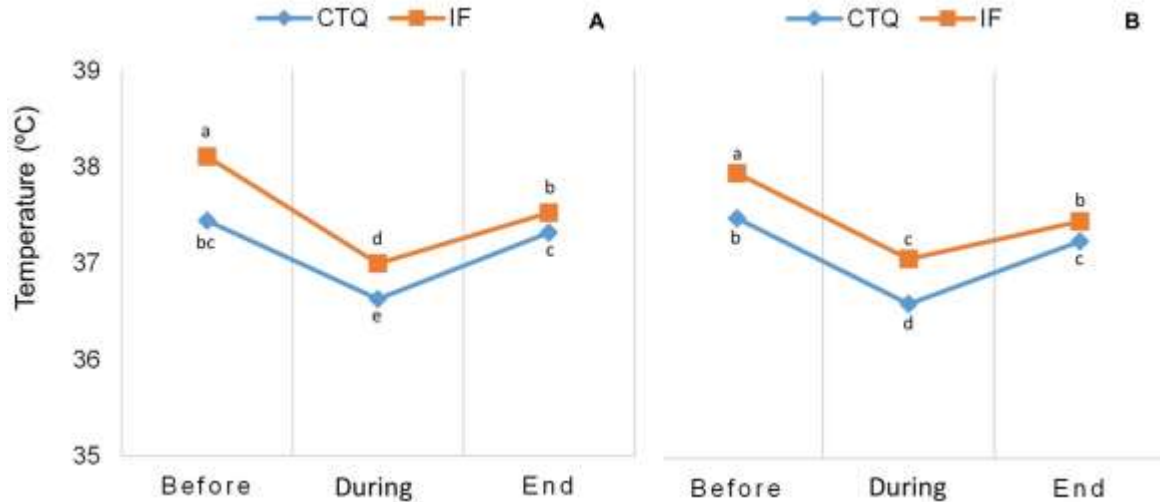
Table 1. Effects of breed and time (before, during and end of procedure) on IRT eye and muzzle temperature obtained during shearing and foot-trimming procedures.

Effect	Eye		Muzzle	
	Shearing	Foot-trimming	Shearing	Foot-trimming
Breed				
CTQ	37.13 ^b	37.11 ^b	31.59 ^a	31.60 ^a
IF	37.54 ^a	37.49 ^a	31.64 ^a	31.59 ^a
Time				
Before	37.77 ^a	37.71 ^a	31.73 ^b	31.75 ^a
During	36.81 ^c	36.83 ^c	31.24 ^c	31.24 ^b
End	37.42 ^b	37.35 ^b	31.88 ^a	31.79 ^a

Temperatures are presented in Celsius (°C). For breed and time, eye and muzzle temperatures during shearing and foot-trimming procedures values with different superscript letters are different ($P < 0.05$).



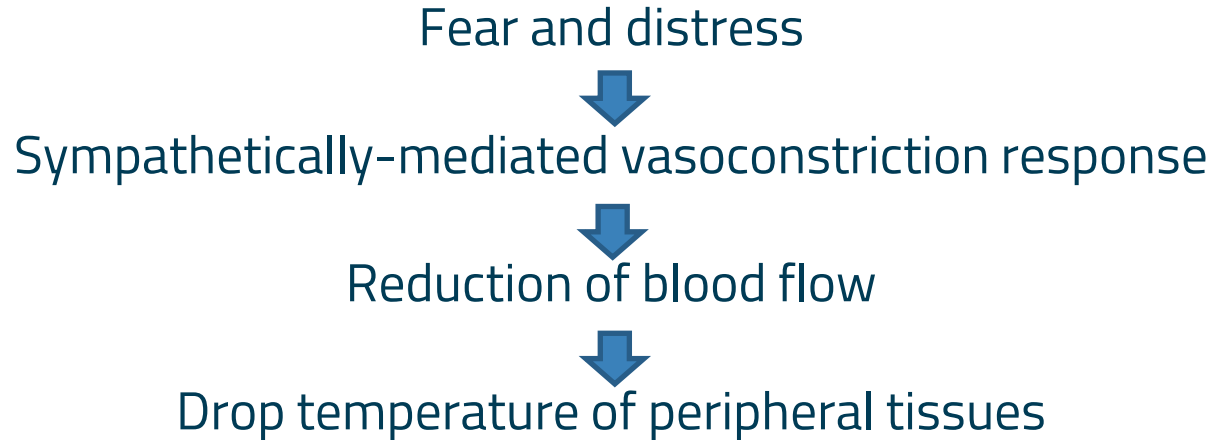
Analysis



- Similar results in cattle (Stewart *et al.*, 2008) and sheep (Stubsjøen *et al.*, 2009; George *et al.*, 2014).

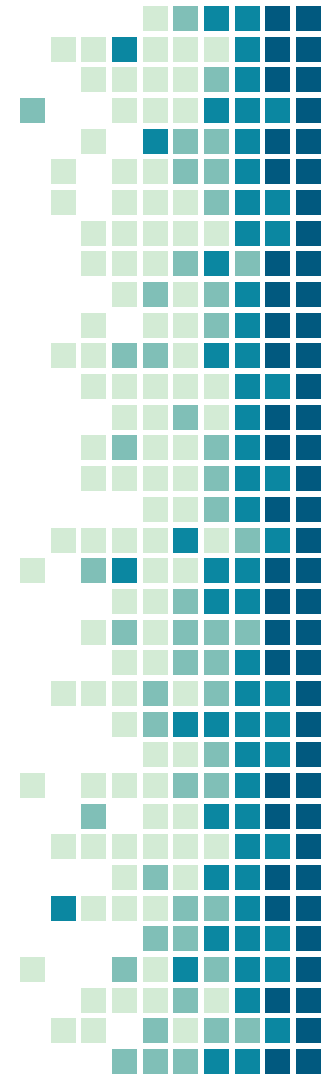
Stewart M., Webster J., Al S., Stafford K., 2008. Infrared thermography and heart rate variability for non-invasive assessment of animal welfare. In: *Aust. New Zeal. Counc. Care Anim. Res. Teach.*, 21: 1–3; Stubsjøen S.M., Flø A.S., Moe R.O., Janczak A.M., Skjerve E., Valle P.S., Zanella A.J., 2009. Exploring non-invasive methods to assess pain in sheep. In: *Physiol. Behav.*, 98: 640–648; George W.D., Godfrey R.W., Ketring R.C., Vinson M. C., Willard S.T., 2014. Relationship among eye and muzzle temperatures measured using digital infrared thermal imaging and vaginal and rectal temperatures in hair sheep and cattle. In: *J. Anim. Sci.* 92:4949–4955.

Why?




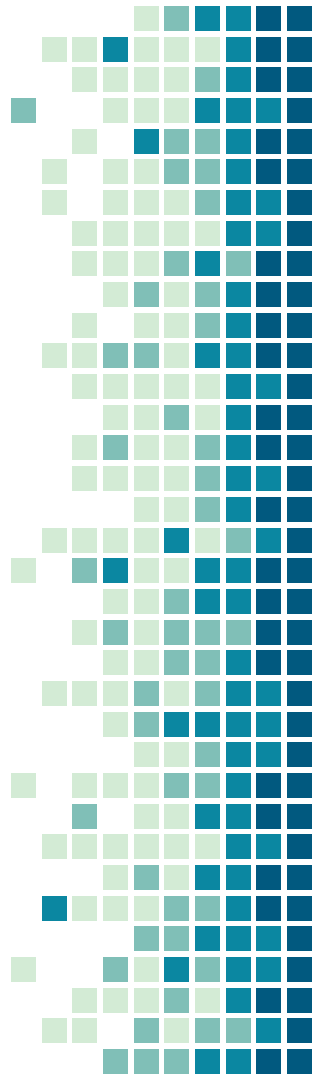
(Herborn *et al.*, 2015)

Herborn K.A., Graves J.L., Jerem P., Evans N.P., Nager R., Mccafferty D.J., Mckeegan D.E.F., 2015. Skin temperature reveals the intensity of acute stress. In: *Physiol. Behav.*, 152: 225–230.



Conclusion

- Eye temperature as a stress indicator 
- IRT as a technique for non-invasive remote stress assessment



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Thank you for your attention.

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Any questions?

