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International Society for Equitation Science

Presents

13th International Equitation Science Conference

22nd–25th November 2017

Charles Sturt University, Australia

Equitation Science in Practice:
Collaboration, Communication and Change

Proceedings edited by

Dr Hayley Randle
Prof. Natalie Waran
Lizzie Kent

Proceedings production: Charles Sturt University Printery
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WELCOME TO WAGGA WAGGA, AUSTRALIA FOR THE ISES 2017 DOWN UNDER CONFERENCE

On behalf of the ISES UK Local Conference Organising Committee, and the School of Animal and Veterinary Science at Charles Sturt University, welcome to Wagga Wagga! This is the 13th International Equitation Science conference and its theme ‘Equitation Science in Practice: Collaboration, Communication and Change’ has been carefully chosen to reflect global recognition of the need for change within the equine industry. Delegates are attending from 17 different countries and most states of Australia.

As with all of our preceding conferences, our underpinning aim is to bring together researchers and practitioners to discuss research and its application across disciplines and multiple nations. Equitation Science as a learned discipline has certainly come of age, with continuing annual conferences now supplemented with regional meetings around the world and publications in a growing number of high-impact journals and public press alike. The Society continues to go from strength to strength, and this year the Local Organising Committee has undertaken the challenge to provide a conference that will address the need for human behaviour change within the equestrian community. This conference is intended to facilitate increased engagement with the evidence-based outcomes of rigorous research conducted by Equitation Scientists over the past decade.

ISES 2017 Down Under has three themes – Collaboration, Communication and Change – all of which will be addressed by a wide range of oral and poster presentations. The packed programme also includes two workshops and a half-day practical exploring Equitation Science in Practice and the education of both humans and horses. Involvement of horses within a university that delivers Equine, Veterinary and Animal Science courses will be examined, specifically the role of Equitation Science. We also have demonstrations of Equitation Science in practice exploring how to adequately prepare and train horses for husbandry procedures, which in some countries can be conducted by non-qualified individuals. Plenty of time is also scheduled for poster viewing, networking and developing future research ideas and collaborations.

The ISES 2017 Down Under Local Organising Committee is grateful to Charles Sturt University, the School of Animal and Veterinary Science staff, and especially the Equine Science and Equine Centre teams. Jaymie Loy and Marion Kater deserve special mention for their work on the practical half day. Alexandria Bailey is sincerely thanked for her work in the initial setting up of the ISES 2017 Down Under conference and bringing us very much ‘online’.

The conference venue and host, Charles Sturt University, is located on Wiradjuri land and abides by the Wiradjuri phrase Yindayamarra-winhanganha, meaning “the wisdom of respectfully knowing how to live well in a world worth living in”. It is entirely fitting that the ISES 2017 conference is taking place in Wagga Wagga; with communication and collaboration the conference should help bring about changes in the equestrian community that will enable our horses to live well in an equine world worth living in.

With dry conditions and high 20s–early 30s°C temperatures forecast, we hope delegates will be able to fit in a dip in the CSU pool and have planned extra time to explore Australia and experience its laid back and friendly culture, a place where you will horses used in many different ways.

Welcome to Australia
Hayley Randle ISES 2017 Down Under LCOC Chair
PRESIDENT’S WELCOME TO ISES 2017 DOWN UNDER

Thank you for being here in Wagga Wagga. I hope you will enjoy the next few days of the conference as much as I know I will! The theme of our conference Equitation Science in Practice: Collaboration, Communication and Change tells us a great deal about what we can expect during this event. I am especially excited to see and hear the presentations in the ‘Standing on the Shoulders of Giants’ section. Many of the people we will hear about have been extremely influential for me, as well as the broader audience of Equitation Science.

As an aside, I have a short story to share... recently I was attending a Retired Racehorse competition in Lexington, Kentucky. I was simply there to help recruit for the University of Kentucky equine programmes. About halfway through my shift, a young lady began talking to me about her interest in pursuing a graduate degree in horse behaviour/welfare. My interest was piqued so I engaged in the conversation, perhaps more thoroughly than some of my earlier conversations of the day. Without prompting, she began talking to me about the field of Equitation Science and how much it had meant to her as a student of horse behaviour. That’s how far we’ve come, folks! I no longer need to assume that every horse person in North America has never heard of Equitation Science!

Back to the conference... there is a rich variety of topics to be presented in the oral and poster presentation sections, with topics ranging from clicker training to tongue-ties, from long distance transportation stress to non-invasive measures of stress. Some abstracts have focused on horse-based measures, others have focused on human-based measures, e.g. measuring attitudes and their impacts on horse treatment. In addition to our Society’s work on horse behaviour studies and welfare studies, we should never forget the potential impact on human safety when we synthesise, assess and implement our findings. I am especially looking forward to the segment on Saturday afternoon about ‘Impacting Human Behaviour Change’... if we have evidence, but have not discovered how to motivate human behaviour change, our progress will be painfully slow.

This conference rounds out my career as Honorary President of the ISES. I am delighted to hand the reins over to our Junior Vice President, Dr Janne Christensen. When I first became involved in the International Society for Equitation Science (the year it was founded in 2007), I had no idea what an important role it would play in my academic career and professional development. ISES, thank you!

Camie Heleski, Honorary President, ISES
ISES 2017 DOWN UNDER LOCAL CONFERENCE ORGANISING COMMITTEE

Hayley Randle (School of Animal and Veterinary Science, Charles Sturt University, Australia)
Natalie Waran (Eastern Institute of Technology, New Zealand)
Jaymie Loy (School of Animal and Veterinary Science, Charles Sturt University, Australia)
Cristina Wilkins (Horses and People Magazine, Australia)
Lizzie Kent (Swales & Willis Ltd, UK)
Cathrynne Henshall (Hillydale Equitation Science and School of Animal and Veterinary Science, Charles Sturt University, Australia)
Jane Williams (Hartpury University College, UK)
Marion Kater (School of Animal and Veterinary Science, Charles Sturt University, Australia)
Heather Ip (School of Animal and Veterinary Science, Charles Sturt University, Australia)
Victoria Condon (School of Animal and Veterinary Science, Charles Sturt University, Australia)

PRACTICAL PRESENTERS
Jenny Austin
Surita Du Preez
Heather Ip
Jaymie Loy
Manuela McClean
Richard van Dijk
Leigh Wills

STUDENT HELPERS
Ella Bradshaw-Wiley
Zali Clarke
Beth Daignault
Palomi Ivanyi
Jacquie Kelly
Adelaide Kovac
Karly Liffen
Alara Nohoglu
Stephanie Papalia
Martina Sardo

Sincere thanks also to Alexandria Bailey (EquiCanine, Australia)
ISES 2017 DOWN UNDER SCIENTIFIC COMMITTEE

Chairs
Dr Hayley Randle (Charles Sturt University, Australia)
Prof. Natalie Waran (Eastern Institute of Technology, New Zealand)

Reviewers
Alison Abbey (Duchy College, UK)
Petra Buckley (Charles Sturt University, Australia)
Hilary Clayton (Michigan State University, US)
Helen Davies (University of Melbourne, Australia)
Raf Freire (Charles Sturt University, Australia)
Carol Hall (Nottingham Trent University, UK)
Elke Hartmann (Swedish University of Agricultural Sciences, Sweden)
Lesley Hawson (Charles Sturt University, Australia)
Camie Heleski (University of Kentucky, US)
Andrew Hemmings (Royal Agricultural College, UK)
Lauren Hemsworth (University of Melbourne, Australia)
Heather Ip (Charles Sturt University, Australia)
Jan Ladewig (Copenhagen University, Denmark)
Jaymie Loy (Charles Sturt University, Australia)
Katrina Merkies (University of Guelph, Canada)
Barbara Padalino (Charles Sturt University, Australia)
Marc Pierard (University of Leuven, Belgium)
Sarah Pollard Williams (Charles Sturt University, Australia)
Hayley Randle (Charles Sturt University, AUS)
Gillian Tabor (Hartpury University College, UK)
Machteld van Dierendonck (University of Ghent, Belgium)
Anna Walker (Duchy College, UK)
Natalie Waran (Eastern Institute of Technology, NZ)
Carissa Wickens (University of Florida, US)
Jane Williams (Hartpury University College, UK)
Janne Winther-Christensen (Aarhus University, Denmark)
Inga Wolframm (Utrecht University, The Netherlands)
WHAT IS ‘SCIENCE’? – BENEFITS AND LIMITATIONS

C. R. Heleski, PhD

University of Kentucky, N-212 Ag Science, North Lexington, KY 40546, US

What does the term ‘science’ mean to you? It’s not as easy to define as one might think, is it? We use the word so often we tend not to think about it. Science comes from the Latin word, scientia meaning knowledge. Wikipedia says science is a systematic approach that builds and organises knowledge in the form of testable explanations and predictions. Further, Wikipedia goes on to state that to be termed scientific, a method of inquiry must be based on gathering measurable evidence subject to specific principles of reasoning. When following ‘the scientific method’ a researcher will follow (approximately) the following steps: formulate a question (for example, can horses understand the difference between harsh tones and soothing tones when given human vocal cues?); perform background research/make preliminary observations; construct a hypothesis (for example, “we hypothesise that horses will perform a learning task more quickly when given supplemental vocal cues in a soothing tone as compared to a harsh tone”); test your hypothesis by performing a carefully designed experiment; analyse the data with sound methodology; arrive at justifiable conclusions; then communicate the results.

So what does this mean in the relatively young field of Equitation Science? On the one hand, it means that the profile of Equitation Science has been raised significantly during the last decade due to an emphasis on measuring the objective, quantifiable aspects of horse–human interactions. For example, we can use rein tension gauges to objectively measure how much tension is taking place between the bit and the rider’s hands during different riding exercises. This coupled with carefully monitoring the horse’s behaviour in response to different rein tensions begins to give us an understanding of which tensions are perceived more or less positively by the horse. We might further add to the rigor of this type of experiment by also measuring heart rates and, perhaps, cortisol levels.

But just because we can utilise quantifiable measurements that are repeatable by other scientists, does this automatically benefit the horse’s welfare? Does it automatically answer our initial question? For example, what of horses that have already become habituated to high levels of rein tension over many years of being ridden in that manner? They may show no significantly aversive behaviours as compared to a horse ridden with a lighter hand, they may show no significantly different cortisol levels or heart rates as compared to the more lightly ridden horse. Does that give us an automatic ‘green light’ to proceed with relatively high tension riding? In my mind, it does not.

There is an important interplay between scientific scrutiny and ethical assessment that must take place if we truly wish to enhance the horse’s well-being in its interactions with us. Scientific evaluation and ethical assessment should not be at odds with one another, rather they should complement one another. As stated at the 2010 conference of this same meeting, science without ethical assessment can be problematic, but so can ethical assessment (or knee-jerk assumptions) without scientific study.

Horses are a highly adaptable species. If we stall them individually for 23 ½ hours per day in a solid-walled box stall, exercise them for ½ h/day in an indoor arena, yet they show no evidence of ulcers, loss of bone density, nor stereotypic behaviour, does this make it an acceptable housing method? If we survey a warm-up arena, and note the 10 most harshly handled horses in the arena
(from our human perspective), yet, upon measurement, they show no measurable differences from 10 control horses, what does this tell us?

The benefits of science and its application to the field of Equitation Science surely outweigh its limitations, but we must always remember to keep our eyes open, watch the whole horse, listen to the whole horse and sometimes remember to trust our horsemanship instincts that brought us to this field to start with.
SCIENTIFIC PROGRAMME

Wednesday 22nd November – registration and welcome reception

- Check into accommodation (from 2pm)
- Conference registration (open from 4pm)
- Posters mounted (from 5pm)
- Presenters can upload and test presentations (pm)
- Formal reception from 6.30pm – includes finger food and drink
- 7pm – Indigenous Australian welcome to country
- 7.30pm – ISES Training Principles (JWC)

Thursday 23rd November: Collaboration and communication

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<td>8.30–8.45</td>
<td>Welcome and housekeeping</td>
<td>Hayley Randle (AU)</td>
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<tr>
<td>8.45–9.00</td>
<td>Welcome to conference</td>
<td>Camie Heleski (US)</td>
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<tr>
<td>9.00–9.15</td>
<td>Welcome to Charles Sturt University</td>
<td>Prof. Glenn Edwards (Head of School of Animal &amp; Veterinary Science, CSU, AUS)</td>
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Chair: Camie Heleski

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<th>Time</th>
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<tr>
<td>9.15–10.00</td>
<td>PLEN 1: Equitation Science in practice: past, present and future</td>
<td>Hayley Randle (AU)</td>
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<tr>
<td>10.00–10.30</td>
<td>Morning tea – Poster viewing and networking</td>
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<tr>
<td>10.30–12.30</td>
<td>Workshop 1: Standing on the shoulders of giants: building foundations for the future of Equitation Science</td>
<td>Prof. Natalie Waran (NZ)</td>
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<td>12.30–1.30</td>
<td>Lunch</td>
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Theme: Equine behaviour and welfare

Chair: Janne Winther Christensen

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<td>1.30–2.00</td>
<td>PLEN 2: Body language and its importance for communication with horses</td>
<td>Jan Ladewig (DEN)</td>
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<td>2.00–2.15</td>
<td>O1: Developing a descriptive reference ethogram for Equitation Science</td>
<td>Marc Pierard (BELG)</td>
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<td>2.15–2.30</td>
<td>O2: Decreased eye-blink rate as a non-invasive measure of stress in the domestic horse</td>
<td>Katrina Merkies (CAN)</td>
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<td>2.30–2.45</td>
<td>O3: The effect of tongue-tie application on stress responses in resting horses</td>
<td>Samantha Franklin (AU)</td>
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<td>2.45–3.00</td>
<td>O4: Behavioural, clinical and respiratory responses to 8-hour transportation in horses</td>
<td>Barbara Padalino (IT)</td>
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<td>3.00–3.15</td>
<td>O5: Clicker training in horses: the importance of the time between click and reward</td>
<td>Iris Huisman (NL)</td>
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<td>3.15–3.45</td>
<td>Afternoon tea – Poster viewing and networking</td>
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Chair: Carol Hall
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<td>3.45–4.00</td>
<td>O6: A code of welfare for horses and donkeys: establishing standards for the welfare of equids in New Zealand</td>
<td>Nicki Cross (NZ)</td>
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<tr>
<td>4.00–4.15</td>
<td>O7: A pilot study for the development of the equine behaviour and research questionnaire (E-Barq)</td>
<td>Kate Fenner (AU)</td>
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<td>4.15–4.30</td>
<td>O8: Attitudes toward the application and use of biometric health data in equine training and care</td>
<td>Emily Fernauld (US)</td>
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<td>4.30–4.45</td>
<td>O9: Field test of an instrument to identify youth perceptions of equine welfare issues among common training practice</td>
<td>Brandon Rice (US)</td>
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<td>4.45–5.00</td>
<td>O10: A pilot study: can whip use changes to improve equine welfare have unintended consequences?</td>
<td>Angelo Telatin (IT)</td>
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<td>5.00–5.15</td>
<td>O11: Opinion by discipline: a content analysis of attitudes and perceptions regarding equine training techniques in an online discussion forum</td>
<td>Elise Lofgren (US)</td>
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<tr>
<td>5.15</td>
<td>Close of day 1</td>
<td>Hayley Randle (AU)</td>
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<td>6.30 onwards</td>
<td>Conference formal dinner – with guest speaker Peta Hitchens speaking on communication and collaboration</td>
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**Friday 24th November: Collaboration and communication**

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<td>8.30–8.40</td>
<td>Welcome and housekeeping</td>
<td>Hayley Randle</td>
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<tr>
<td>8.40–8.55</td>
<td>Welcome to Charles Sturt University</td>
<td>Prof. Tim Wess</td>
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<td>Executive Dean,</td>
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<td>Faculty of Science, CSU</td>
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<tr>
<td>8.55–9.00</td>
<td>Recap on day 1: Communication and collaboration within the context of Equitation Science</td>
<td>Hayley Randle</td>
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**Theme: Ethical and welfare considerations in the equine industry**

**Chair: Paul McGreevy**

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<tr>
<td>9.00–9.45</td>
<td>PLEN 3: The power of collaboration: improvements to safety and welfare in racing</td>
<td>Peta Hitchens (AU)</td>
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<td>9.45–10.00</td>
<td>O12: We shouldn’t fear the conversation: a holistic, ethics-based welfare assessment of the Thoroughbred racing industry, from foals to retirees</td>
<td>Camie Heleski (US)</td>
</tr>
<tr>
<td>10.15–10.30</td>
<td>O13: Reducing horse-related injury and fatality: findings from a WHS-driven systematic accident investigation of a high-profile death in Australia</td>
<td>Meredith Chapman (AU)</td>
</tr>
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<td>10.30–10.45</td>
<td>O14: The role of heart rate monitoring to assess workload during maintenance interval training in national hunt racehorses</td>
<td>Jane Williams (UK)</td>
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<tr>
<td>10.45–11.15</td>
<td>Morning tea – Poster viewing and networking</td>
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### Chair: Hayley Randle

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<td>11.15–11.30</td>
<td>O15: It’s all about the sex: preconceived ideas about horse temperament based on human gender and sex</td>
<td>Kate Fenner (AU)</td>
</tr>
<tr>
<td>11.30–11.45</td>
<td>O16: Selection of suitable personality traits evaluated via linear traits in American Quarter Horses</td>
<td>Sandra Kuhnke (DE)</td>
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<td>11.45–12.15</td>
<td>O17: The Australian equine industry</td>
<td>Jaymie Loy (AU)</td>
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<td>12.15–1.15</td>
<td>Lunch – preparation for practical session</td>
<td>Jaymie Loy (AU)</td>
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<td>1.15–1.30</td>
<td>Transport to CSU Equine Centre (800m)</td>
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#### Theme: Equitation Science in practice: educating humans and horses

**Coordinator:** Jaymie Loy

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<td>PLEN 4: Foundation training of three-week-old Thoroughbred foals</td>
<td>Leigh Wills (NZ)</td>
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<td>Heather Ip (AU)</td>
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<td>Walking tour: A day in the life of a university teaching horse</td>
<td>Jaymie Loy (AU)</td>
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<td></td>
<td>Saving lives: The difference one horse can make</td>
<td>Surita DuPreez (AU)</td>
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<td>3.15–4.00</td>
<td>PRACTICAL: Handling and training for hoof trimming</td>
<td>Richard van Dijk (AU)</td>
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<td>Jenny Austin (AU)</td>
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<tr>
<td>4.15–5.00</td>
<td>Learning theory and training of young riders</td>
<td>Manuela McLean (AU)</td>
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<tr>
<td>5.00</td>
<td>Close of day 1</td>
<td>Hayley Randle (AU)</td>
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<tr>
<td>5.15</td>
<td>Transport back to main campus</td>
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<tr>
<td>6.00</td>
<td>Buses depart to Wagga Wagga for relaxing and networking at the Cork and Fork festival, at the Civic Centre Precinct hosted by Borambola wines. ISES VIP area with complimentary glass of wine</td>
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<tr>
<td>9.30; 10.30</td>
<td>Buses depart for CSU</td>
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### Saturday 25th November: Change

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<tr>
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<td>Welcome and housekeeping</td>
<td>Hayley Randle</td>
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<tr>
<td>8.40–8.50</td>
<td>Welcome to Charles Sturt University</td>
<td>Prof. Andrew Vann</td>
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<td>Vice Chancellor CSU</td>
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<tr>
<td>8.50–9.00</td>
<td>Recap on day 2: Collaboration and communication within the context of Equitation Science</td>
<td>Hayley Randle</td>
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**Theme: Measuring equine behaviour**

**Chair:** Andrew McLean
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<tr>
<td>9.00–9.30</td>
<td>PLEN 5: Through their eyes: the challenge of assessing equine emotional state</td>
<td>Natalie Waran (NZ)</td>
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<td>9.30–9.45</td>
<td>O18: Using the Five Domains Model to assess the impact of husbandry and equitation procedures on horse welfare</td>
<td>Paul McGreevy (AU) (presenting for Bidda Jones)</td>
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<td>9.45–10.00</td>
<td>O19: The effect of different bits, bridles and rein handling on rein tension and muscle trigger point reaction</td>
<td>Sandra Kuhnke (DE)</td>
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<td>10.00–10.15</td>
<td>O20: Horses’ voluntary acceptance of rein tension with various bitless bridles compared to a single-jointed snaffle bit</td>
<td>Anina Vogt (DE) (presenting for Uta König von Borstel)</td>
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<td>10.15–10.30</td>
<td>O21: An opportunistic pilot study of radiographs of equine nasal bones at the usual site of nosebands</td>
<td>Fiona Crago (AU)</td>
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<tr>
<td>10.30–11.00</td>
<td>Morning tea – Poster viewing and networking</td>
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**Theme: Human behaviour change**

**Chair: Natalie Waran**

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<tr>
<td>11.00–11.45</td>
<td>Plenary 6: Behaviour change in horse owners to safeguard horse welfare</td>
<td>Lauren Hemsworth (AU)</td>
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<tr>
<td>11.45–12.00</td>
<td>O22: Introducing human behaviour change for animals: a new approach to sustainable change for horses</td>
<td>Debbie Busby (UK) (presenting for Suzanne Rogers)</td>
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<tr>
<td>12.00–12.15</td>
<td>O23: Are views regarding show horse welfare influenced by owners’ perceived locus of control?</td>
<td>Lauren Brizgys (US)</td>
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<td>12.15–12.30</td>
<td>O24: How Australian horse owners determine if their horses have their social and behavioural needs met: findings from a mixed-methods survey of 505 horse owners</td>
<td>Kirrilly Thompson (AU)</td>
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<td>12.30–12.45</td>
<td>O25: Does leadership relate to social order in groups of horses and can it be transferred to human–horse interactions?</td>
<td>Elke Hartmann (SE)</td>
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<tr>
<td>12.45–1.00</td>
<td>O26: Teaching Equitation Science as a collaborative, communicative and ever-changing partnership of coach, student and horse</td>
<td>Cristine Hall (AU)</td>
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<tr>
<td>1.00–1.15</td>
<td>O27: The interface between genetic research and social media: citizen scientists, crowd-funding and the campaign for change</td>
<td>Shelia Ramsay (NZ)</td>
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<td>1.15–1.30</td>
<td>O28: The Australian horse industry: culture, scope and governance – the drivers of change in horse management and opportunities for collaboration with Equitation Science</td>
<td>Jenny Carroll (AU)</td>
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<tr>
<td>1.30–2.30</td>
<td>Lunch</td>
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<tr>
<td>2.30–3.30</td>
<td>Workshop 2: Do you understand me or should I shout louder? Bringing about human behaviour change in the equine industry</td>
<td>Nicolas de Brauwere MRCVS (UK)</td>
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<tr>
<td>3.30–4.00</td>
<td>Afternoon tea – Poster viewing and networking</td>
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<td>Time</td>
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| 4.00–4.45    | Panel: Collaboration, communication and change for the future | Nicolas de Brauwer MRCVS (UK)  
Lauren Hemsworth PhD (AU)  
Peta Hitchens PhD (AU)  
Prof. Natalie Waran (NZ)  
Jenny Carroll (AU) |
| 4.45–5.00    | Closing comments                                       | Hayley Randle ISES SVP (AU)  
(Where we have come from)  
Camie Heleski ISES Pres (US) (Where we are now)  
Janne Winther Christensen ISES JVP (DEN)  
(Where we are going) |
| 5.00–5.15    | Student Awards and LCOC thanks                         | ISES Presidents  
ISES 2018  
Official close of conference |
| 5.30 onwards | AGM                                                    |                                                                          |
### Equitation Science in practice: educating humans and horses

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<td>1.30–3.00</td>
<td>PLEN 4: Foundation training of three-week-old Thoroughbred foals</td>
<td>Leigh Wills (NZ) Heather Ip (AU)</td>
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<td>Walking tour: A day in the life of a university teaching horse</td>
<td>Jaymie Loy (AU)</td>
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<td>Saving lives: The difference one horse can make</td>
<td>Surita DuPreez (AU)</td>
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<tr>
<td>3.15–4.00</td>
<td>PRACTICAL: Handling and training for hoof trimming</td>
<td>Richard van Dijk (AU) Jenny Austin (AU)</td>
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<tr>
<td>4.15–5.00</td>
<td>Learning theory and the training of young riders</td>
<td>Manuela McLean (AU)</td>
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<tr>
<td>5.00</td>
<td>Close of day 1</td>
<td>Hayley Randle (AU)</td>
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<tr>
<td>5.15</td>
<td>Transport back to main campus</td>
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All activities undertaken as part of the 2017 International Society of Equitation Science conference practical day are approved by the Charles Sturt University Animal Care and Ethics Committee (approval number A17070). This approval includes all associated risk assessments for these demonstrations. The ISES 2017 LCOC will stop any activities deemed to be having a negative impact on horse welfare.
BIOGRAPHIES OF PLENARY SPEAKERS, WORKSHOP COORDINATORS AND PRACTICAL DAY PRESENTERS

Jenny Austin – Jenny Austin’s Equine Services

Jenny is a qualified ACEHP Natural Hoof Care Practitioner with a background in a variety of horse disciplines with endurance and Arabian horses being particular favourites. In her business, she has a full-time trimming round and conducts regular workshops on hoof health and other topics, specialises in laminitis cases and has a particular interest in equine nutrition as it relates to hoof health.

Jenny was introduced to Equitation Science principles by having regular lessons with Nicki Stuart of Kersbrook Equestrian Centre. When Jenny and Richard met, both found that they were on the same pathway with their horse training. As a team, they created a method of working together, incorporating overshadowing, among other things, to enable horses to stand quietly for trimming and other tasks.

Nic de Brauwere MRCVS – Head of Welfare Rehabilitation and Education, Redwings Horse Sanctuary

Nic de Brauwere is Head of Welfare Rehabilitation and Education at Redwings Horse Sanctuary, the UK’s largest horse charity. Nic is also a director of the National Equine Welfare Council (NEWC) whose purpose is to protect horses, ponies, donkeys and mules by providing support, guidance and a communication forum to equine organisations, businesses and charities to help raise raise equine welfare standards nationwide.

He graduated as a veterinary surgeon in 1991 from Onderstepoort in South Africa and has worked at Redwings Horse Sanctuary since then providing clinical services, herd health management, welfare department support and staff training. In 2002 he was appointed Senior Welfare Veterinary Surgeon and has dealt with many individual cases, large-scale rescues in Devon, Gelligaer and Lincolnshire, worked with NEWC members – SWHP, EHPPS and World Horse Welfare and has testified in Magistrate and Crown Courts for RSPCA prosecution cases. In 2004 he was co-opted onto the NEWC Executive Committee. His interests include the theoretical and practical aspects of working with unhandled, semi-feral equines, finding solutions for equines suffering in private ownership and improving awareness of welfare issues affecting the older and/or unhandled equines by educating owners and colleagues in appropriate solutions to problems.

Nic has been a regular contributor to the International Society for Equitation Science over the past decade and brings valuable experience of working at the research–practice interface and strongly believes in the need for meaningful co-operation between all of those involved with equids in order to tackle issue-driven problems, improve understanding and communication, and effect changes in practice.

Richard van Dijk – Train Teach Trim

Richard’s business in South Australia is called Train Teach Trim which means ‘Train the horse, teach the human, trim the hooves’. Horses come to his property for starting to saddle and harness, ground work, re-training, etc. He also gives riding, driving and handling lessons to people and travels around trimming the hooves of approximately 30–40 horses a week.
Richard is a second-generation horseman having lived and worked with horses his whole life, experiencing a huge range of horse activities. Pony Club member from age 6, Richard was breaking in horses to harness and saddle with his father from age 12. He has competed in eventing, novelties, dressage, show jumping, tetraathlon, show carriage driving, Royal Show section fours, hunting, picnic races and participated in various festivals, parades and weddings with his harness horses. Richard has successfully trained horses for disabled people and several tourist facilities to be calm and cope with difficult environments.

Richard came to realise that the early work he did with his father and the Pony Club was the same as Tom Roberts’ methodology. Equitation Science and Dr McLean’s methods clarified and consolidated the training principles that already made the most sense to him. Particularly appealing to Richard about Dr McLean’s system is that it’s safe, calm and comfortable for the horse and handler.

He was trained in natural hoof care by Jenny Austin and co-presents at her hoof health workshops. When Richard became a professional hoof trimmer, he quickly realised that horse training is lacking when it comes to standing quietly for the hoof care practitioner. Using his excellent timing, experience and Equitation Science principles, he has developed a successful method of handling and training for this area.

Lauren Hemsworth PhD – PhD Research Fellow

Dr Lauren Hemsworth is a Research Fellow at the University of Melbourne’s Animal Welfare Science Centre (AWSC). Lauren’s career to date has focused on improving the welfare of domestic animals. She has considerable research experience in the behaviour and welfare of domestic animals, with an emphasis on the human–animal relationship, animal welfare assessment and the development and validation of behavioural and welfare indicators. Lauren holds a BSc (Hons) majoring in Zoology from the University of Melbourne, and a Doctorate from Monash University.

Her Honours research investigated the effects of an isolation period in an animal shelter on dog behaviour and welfare, by measuring changes in a dog’s fear of humans and physiological stress levels (IgA concentrations) over an eight-day period.

Lauren’s doctoral research (‘The Welfare of Recreational Horses in Victoria: The Occurrence of and Factors Associated with Horse Welfare’) examined recreational horse ownership in Victoria and investigated the relationships between horse owner attributes and horse welfare outcomes. This involved a large random demographic telephone survey, and an on-site horse and horse owner inspection, which included a human attitude and knowledge survey, a horse husbandry and management survey, and a horse health and welfare assessment. The research findings provided evidence of relationships between horse owner attributes, including attitudes and behaviour, and horse welfare outcomes. Importantly, horse owner husbandry and management behaviour was associated with horse welfare outcomes. The observed relationships imply that improving a horse owner’s knowledge is likely to result in favourable attitudes towards, and therefore potential improvements in, horse husbandry and management behaviour and subsequently reduce the welfare problems found in recreational horses in Victoria (Hemsworth, 2012). These findings demonstrated the opportunity to manipulate the human–horse relationship via targeted education in order to improve the husbandry and management behaviour of horse owners and potentially reduce the incidence of poor welfare in recreational horses.
In her current role at the AWSC, Lauren is leading a range of projects including the development and validation of an animal welfare assessment tool capable of assessing the welfare of a range of animal species in-situ; examining the zoo keeper–zoo animal relationship; investigating consumer perceptions and attitudes in the red meat industry; the development of education and training programmes to modify horse owner behaviour in order to improve horse welfare outcomes; conditioned feeding to increase feed intake in lactating sows; and the relationship between sham-chewing and welfare in group-housed gestating sows.

Lauren was awarded the ABARES Science and Innovation award for Animal Welfare (2015). She is a reviewer for six journals. Lauren is currently supervising one MVSc, one Honours and two PhD students.

**Peta Lee Hitchens, BAppSci, MVPHMgt, PhD – Research Fellow**

Dr Hitchens is a Research Fellow in Equine Veterinary Epidemiology at the University of Melbourne. She combines expertise in epidemiological research of equine and human health, safety and welfare with experience working in the racing industry in regulation and operations management.

In 2016, Peta joined the University of Melbourne’s Equine Orthopaedic Research Group, a multi-disciplinary team that aims to determine the causes of musculoskeletal injuries in horses by developing mathematical and epidemiological models of bone biology processes. Their primary goal is to work alongside the racing industry to develop evidence-based strategies that reduce the occurrence of such injuries.

Prior to joining the University of Melbourne, she held positions at the Swedish University of Agricultural Sciences, the University of California, Davis and in the Tasmanian racing industry.

Peta’s research at UC Davis showed that catastrophic musculoskeletal injury to the horse was the leading cause of substantive jockey injury, demonstrating clearly that detrimental animal welfare can also directly impact humans. She also conducted the first large-scale epidemiological analysis of routinely collected data on animal welfare inspections for the Swedish Department of Agriculture, with a focus on poor welfare of animals used in sports and entertainment.

It is Peta’s cross-faceted experience working between industry, government and academia that has driven her viewpoint on the importance of collaboration in order to ensure that evidence-based strategies are employed to benefit the health, safety and welfare of horses and their riders alike.

**Professor Jan Ladewig – ISES Honorary Fellow**

Jan Ladewig is a veterinarian from the Royal Veterinary and Agricultural University in Copenhagen. He has a PhD degree in Animal Behaviour from the University of California, Davis, US. He has worked at a German research institute studying behavioural and physiological reactions to stress in cattle, pigs and horses and he has developed a method for the quantitative measurement of motivation for animals to perform natural behaviour. He is a professor at Copenhagen University teaching behaviour and welfare of domestic animals to vet students and animal science students. In addition, he has supervised numerous PhD and Masters students.
Jan Ladewig is a member of the International Society of Applied Ethology (ISAE) since 1982. From 1992–1994 he was president of the society. He has also been a member of the International Society for Equitation Science (ISES) since its beginning and has been an Honorary Fellow of the Society since 2007.

In addition to having worked as a practising horse vet, Jan is an active rider. His main interest is the scientific background of training horses, especially from a safety and welfare point of view. He lives with his wife and youngest daughter in the countryside west of Copenhagen, Denmark and owns 2½ horses.

**Manuela McLean – Co-Director, Equitation Science International**

Highly sought after as a National Coach in Dressage, Manuela McLean regularly conducts clinics within Australia and internationally, including in New Zealand, England, Scotland, The Netherlands, South Africa and Canada. She also teaches private lessons and clinics at the AEBC in Clonbinane, VIC, and at Bassinghall in Tuerong, VIC.

Manuela’s reputation for her pursuit of excellence precedes her. Having competed to FEI level in dressage and Advanced three-day eventing, Manuela complements her teaching by keeping up-to-date with the latest scientific knowledge at conferences such as ISES and the Global Dressage Forum. With a particular interest in the biomechanics of horse and rider, she imparts this knowledge during her lessons to pupils of all ages and levels.

Manuela co-developed the AEBC training system and, in 2002, co-authored *Horse Training the McLean Way*. Since then, Andrew and Manuela have released *Academic Horse Training*, along with a series of three DVDs. Manuela has also written numerous articles on training, focusing particularly on teaching children and their ponies. She plans to write a book for children on how to train the perfect pony.

Evidence of her abilities, one of Manuela’s recent achievements was coaching and training Paralympian Joanne Formosa and her stallion, Worldwide PB, to gold medal victory at the 2012 London Paralympics. In just six months, Manuela trained Worldwide PB to be a competitive Paralympic mount responsive to verbal and postural cues. Worldwide PB learned to respond to the lightest of aids and, together, he and Joann achieved Paralympic success.

**Associate Professor Hayley Randle BSc (Hons), PhD – ISES Senior Vice President**

Hayley graduated with a BSc (Hons) Biology and Psychology in 1990, and gained her PhD in Animal Science on cattle in 1995 at Exeter University, UK. Hayley has worked in higher education for over 20 years, delivering a range of animal, welfare, statistics and more recently Equitation Science, subjects to a variety of land-based students. She has enjoyed delivering to a wide range of undergraduate students in a number of institutions and took up the post of Associate Professor in Equine Science at Charles Sturt University in September 2016.

Hayley has led a number of projects to develop academic land-based programmes that closely align with contemporary industry needs. Hayley has also done extensive work on Teaching and Learning Quality Assurance on a national level and has undertaken expert witness work
specialising in horse behaviour. Hayley is a regular and frequent reviewer for a number of high-impact animal and veterinary journals and has examined PhDs internationally.

In 2007 Hayley became one of the inaugural Council Members of the International Society for Equitation Science Council and is currently the Senior Vice President. She is regularly involved in the Scientific Committee for the annual ISES conference, and chaired these in 2012 and 2016. Hayley is chairing the ISES 2017 Organising Committee and the Scientific Committee for the ISES 2017 Down Under conference at CSU in Wagga Wagga.

**Professor Natalie (Nat) Waran BSc (Hons), PhD – ISES Founder and Honorary Fellow**

Nat is an applied scientist by training, and an educationalist at heart. She describes her research and education interests as being in the field of ‘One Welfare’ – the relationship between animal and human health and welfare, an interdisciplinary area combining aspects of: social sciences, health and veterinary sciences with education, ethics and law. She has a long standing research and practical interest in horse behaviour and welfare, having published on a number of topics including: horse transport, welfare assessment, temperament testing, weaning, feeding and stereotypies, indicators of stress and pain behaviours. Her interest in equine training, performance and welfare led to her being a co-founder of the International Society for Equitation Science (ISES) with the first workshop on Equitation Science being held in Edinburgh in 2004. She served as the inaugural Senior Vice President for the first few years of the organisation’s history and was flattered to be made an Honorary Fellow in 2014.

Natalie gained a first class Zoology degree from Glasgow University, and her PhD from Cambridge University’s Veterinary School funded by the British Veterinary Association’s Animal Welfare Foundation. In 1990, she joined Edinburgh University as a young lecturer to develop and direct a unique Postgraduate Masters programme in the new area of Applied Animal Behaviour and Animal Welfare. This was the first PG programme for the emerging discipline, and it is still considered the gold standard qualification in the field after 26 years. After 14 years, during which time she developed a number of other educational and research initiatives at Edinburgh, including an MSc in Equine Science, an equine behaviour referral clinic based at the veterinary school and led an anthrozoology and animal welfare research group, she and her family decided to make a life-changing move to New Zealand when she was invited to become the Chair of Animal Welfare at Unitec Institute of Technology in Auckland. Nat worked at Unitec for just over 6 years, taking up the role of Head of the School of Natural Sciences and Associate Dean (Research) in the Faculty of Social and Health Sciences, and developing the animal behaviour and welfare research and educational programmes there.

Early in 2011 she decided to leave Unitec and New Zealand to take up the exciting new challenge of developing a new centre of excellence for international animal welfare education, supported by a generous £2 million grant from the Marchig Animal Welfare Trust. As the inaugural Director of the new Jeanne Marchig International Centre for Animal Welfare Education, she has developed international networks and working partnerships with overseas governments, universities, professional bodies and NGOs, to develop and deliver innovative capacity building initiatives for improving the quality of life for animals and the people that rely on them, through education, capacity building training and by influencing policy at the highest level. This has involved the development of accessible education packages, translated into a number of languages, MOOCs (Massive Open Online Courses), new online International PG Masters programmes, shared international pathways in UG and PG degrees, international government-level workshops for
policy advisors, veterinarians and health professionals within the area of One Health and One Welfare, and the general promotion of the new multi-disciplinary area of ‘One Welfare’. Combined with her joint role as the University of Edinburgh’s Royal (Dick) School of Veterinary Studies’ Associate Dean (International), and her university role as part of the global executive, Nat has considerable experience with working in many different parts of the world, and in particular across Asia. In 2016, after 5 wonderful years back in Edinburgh, Natalie and her family (including 2 horses, 3 dogs and 3 cats) decided they needed to live where there are higher temperatures and more sunshine hours, and so she recently returned to New Zealand to take up the position of Professor of One Welfare and Executive Dean at the Eastern Institute of Technology in sunny Hawkes Bay.

Leigh Wills – Equus Education (NZ) Ltd

Leigh Wills is the founder and director of Equus Education (NZ) Ltd; innovators who specialise in understanding what is natural for the horse and how this can be incorporated within the Thoroughbred breeding and racing environment. Leigh is two times New Zealand national eventing title holder, and the first student to become a Monty Roberts instructor worldwide. She is a writer of NZQA papers and an experienced international presenter.

Equus Education (NZ) Ltd created a foal education process and have completed over 18,000 training sessions without injury, with over 2,000 foals graduating from their programme. Their graduates have become million dollar yearlings in the sales ring and multiple group one winning racehorses.

The studs they work with have experienced zero horse or human injuries when handling those foals that have graduated their education programme – a fact of which Equus Education are understandably very proud. The studs have also been able to shorten their weanling training programme considerably, saving time and money.

The success of a foal’s future racing career is underpinned by the collaboration and communication of all the parties involved in their well-being. The breeding industry is made up of many professionals that specialise in their field of expertise. Equus Education is an integral part; the behaviours the foals learn are the foundation on which their racing careers are built. Equus Education continue to learn and share knowledge as any change can only take place if the whole industry is committed.

Leigh studied with Dr Andrew MacLean and collaborated with him, Massey University and Waikato University to present their findings at the ISES 2016 conference in France. For research, Equus Education have access to a large study group and are dependent upon collaborating with other academic institutions to fulfil their desire to understand more about young Thoroughbred foals. For 2017 they are collaborating with KU Leuven University to measure the mental states of mares and foals and the interaction between them.
BIOGRAPHIES OF CHARLES STURT UNIVERSITY SENIOR MANAGEMENT STAFF

Professor Glenn Edwards – Head of School of Animal and Veterinary Science CSU

Glenn is Professor of Veterinary Surgery and Head of the School of Animal and Veterinary Sciences. He teaches in all aspects of soft tissue surgery with a particular interest in minimally invasive surgery, wound healing and surgical management of cardiovascular and urinary tract problems.

Glenn is also active in the development of a variety of surgical techniques and implantable devices destined for both veterinary and human clinical use, such as improved urinary tract and cardiovascular surgical procedures, vascular grafts, left ventricular assist devices and heart valves. He has been a successful collaborator in 17 competitive research grants and numerous additional research contracts, and has published over 100 papers and chapters in textbooks in the veterinary, biomaterial and medical literature.

Glenn was the recipient of the 2006 TG Hungerford Award for Excellence in Post Graduate Education, the 2011 ASAVA Distinguished Scientific Contribution Award and was awarded the CSIRO medal for Research Achievement together with colleagues from CSIRO in the development of a new tissue adhesive in 2012.

Professor Tim Wess – Executive Dean Faculty of Science CSU

Professor Tim Wess was appointed as Executive Dean, Faculty of Science CSU, in May 2013. He was the Head of the School of Optometry and Vision Sciences, Pro Vice Chancellor for Estates and Chairman of the Wales Optometry Postgraduate Education Centre at Cardiff University. Professor Wess was also a member of the governing body at the University of Newport. He has held a number of scientific administrative roles at both national and international level in numerous countries, and has vast experience in innovation and engagement, communicating science to the public, advising science and health policy and has also worked with charities globally.

Tim’s research interests are in order and disorder in the structure of biological systems, notably the interactions in biological materials within contemporary to archaeological contexts.

Tim manages 8 schools within a wide regional geographical spread. Since his arrival, the faculty has already rejuvenated the management structure of the faculty and developed two major themes for the faculty as Food and Water Security and Health Ageing. Tim has made a significant improvement to the scrutiny, management and therefore the financial viability of the human and animal clinics. Tim has brought his strong belief in equality to the University and recently completed a graduate certificate in Wiradjuri to show his commitment to the aboriginal people on whose land Charles Sturt University is located.
Professor Andrew Vann – Vice Chancellor and President CSU

Professor Vann trained as a civil engineer and worked in engineering consultancy before completing a PhD in the Civil Engineering Systems Group at the University of Bristol in 1994. He lectured in structural engineering at the University of Bristol prior to coming to Australia in 1996 where he took up a similar post in the Faculty of Engineering at Central Queensland University in Rockhampton. During this time he pursued research interests in structural monitoring and artificial intelligence, as well as leading pedagogical change in moving the Bachelor of Engineering at CQU to a project-based format.

He held various senior academic and administrative roles at CQU before joining James Cook University in North Queensland in 2004 as Pro Vice-Chancellor Information Services and Technologies, subsequently Pro Vice-Chancellor and, from 2008, was Senior Deputy Vice-Chancellor with responsibility for the Faculties and Teaching and Learning.

Professor Vann joined Charles Sturt University as Vice-Chancellor in December 2011. He has held a number of board and community leadership roles, is a Fellow of the Australian Institute of Company Directors, a Fellow of the Australian Institute of Management, Associate Fellow of the Australian Rural Leadership Foundation and a Fellow of the Institute of Engineers Australia.
ABSTRACTS
COLLABORATION AND COMMUNICATION

THEME: COLLABORATION

“The action of working with others to produce something”

THEME: COMMUNICATION

“The imparting or exchanging of information”
The International Society for Equitation Science (ISES) has formally existed as a learned society since 2007 and during this time has hosted annual international conferences in many different countries. However, conferences are yet to be held in some of the countries with arguably the most substantial influences on global equestrianism. The development of Equitation Science has been substantially informed by a number of critical cornerstones including equine ethology, learning theory (which has been logically used by ISES to create the fundamental Principles of Training that underpin all horse–human interactions) and animal welfare. The mission of ISES is to promote and encourage the application of objective research and advanced practice which will ultimately improve the welfare of horses in their associations with humans and although the sheer volume and the breadth of research conducted over the past decade has undeniably helped some of ISES’s aims and objectives to be met, there is still a long way to go. It is imperative that the core activity of Equitation Science should remain the generation of rigorous, reliable and robust evidence-based findings to support horse and human education and practice.

The global horse industry is changing and like it or not, this is a fact. There is a worldwide increase in attention on all aspects of horse welfare ranging from keeping conditions (e.g. turnout), use (e.g. pregnant mare urine), discipline-specific practices (e.g. whisker trimming), performance-related actions (e.g. soring) and training methods (e.g. rollkür) to rehoming, rehabilitation and retraining through to euthanasia. Equitation Science research has investigated and started to determine which methods, approaches and equipment promote ethical and sustainable practice. Consequently, Equitation Science is well placed within the wider world of animal welfare, which itself is undergoing a mindset change, moving away from primarily resource-based indicators to animal-based indicators of welfare. Equitation Scientists with their enthusiasm and access to industry practitioners are well positioned to begin to, or arguably continue to, understand what these individual horse-based indicators may be, how they can be measured and ultimately how they can be best used at practitioner level.

As a body of researchers and practitioners, Equitation Scientists have worked hard to ensure that studies undertaken are based on sound experimental design to minimise error and the production of questionable results. The use of technology has been widely embraced and this has been further facilitated by the growing availability of increasingly smart and portable equipment that is affordable and easily fitted to horses and humans. However, this in itself has potentially led to some difficulties with the volume of data produced, perhaps some lack of maintenance and calibration of the equipment used, small sample sizes and, it may even be argued, the use of abductive scientific reasoning whereby either findings ‘fit’ expectations, or hypotheses are unknowingly modified to suit findings albeit with the best of intentions with regard to ultimately improving horse welfare.

The horse–human relationship is central to all equestrian pursuits and here lies an additional problem: it is difficult, even with the best of intentions, to remain objective when observing,
reporting and interpreting equid behaviour in the most rigorously designed studies. Equitation Science has always been proud of its multi-disciplinary approach (not only in terms of input but also output with regards to application across equestrian disciplines) and has been proactive in adopting technologies that have been successfully used in sport science, materials science and engineering to name a few, in the quest to objectively study multiple aspects of the horse–human relationship. However, it is now time to do the same with social sciences, and embrace the approaches that have been successfully used in human-based studies to improve human welfare, and integrate them with purely quantitative methodologies with the aim of achieving an outcome that is greater than a purely quantitative or qualitative approach.

Rather unusually, as a Learned Society ISES has an active practitioner membership who work alongside academic members and regularly attend conferences in order to access information that can be used to inform their professional practice and to engage in collaborative discussion regarding future research directions. As a maturing organisation ISES needs to persist with increasing its inclusivity and in so doing widen its reach both within local environs and globally. This goal can only be reached if Equitation Scientists continue to hone their collaboration and communication skills. To date engagement with Equitation Science findings has depended very much on the audience, with some offerings of our findings falling on seemingly deaf ears, particularly where findings appear to challenge traditional and established practice. On the contrary, there have been occasions where interested parties have extracted part-findings from Equitation Science research and used them selectively, and even incorrectly, in support of practices that neither align with the ISES mission nor promote ethical and sustainable equestrian practice. However, regular issuing of media releases and position statements combined with lay press articles and publications in peer-reviewed journals has increased the availability of contemporary Equitation Science research findings to practitioners.

Although ISES has achieved much to date (despite its relative brief history), given the rapid changes occurring in the horse industry and increasing welfare- and human safety-based drivers, it is ever more important to improve on our collaboration and communication skills in order to disseminate our findings more effectively. It is clear from developments occurring in a variety of sectors within the animal industry that change needs to take place at multiple levels, starting with individuals, and that understanding the change process is critical if we are to work with and help those within industry needing to change their practice, almost certainly under duress. Behaviour change specialists recognise that change inevitably causes discomfort, therefore it is up to us as Equitation Scientists and potential ‘leaders’ to help make sure that this reticence and resistance to change is managed in a positive and productive way within the equine industry.

**Lay person message:** The International Society for Equitation Science promotes ethical and sustainable practice across all equestrian uses and disciplines. For Equitation Science to continue to produce evidence-based findings that can be used to improve the welfare of horses, and at the same time the health and safety of both horses and humans, studies must be well designed and the resulting data robust in order to inform changes in practice. However, since any suggestion of change causes discomfort, it is up to us as Equitation Scientists to positively support individuals who will certainly be reticent and resistant to changing equestrian practice.

**Keywords:** Equitation Science; Practice; Welfare; Collaboration; Communication; Change
Sir Isaac Newton famously wrote; “If I have seen further it is only by standing on the shoulders of giants” (*náanos gigantum humeris insidentes*), conveying the notion of discovering ‘truth’ by building on previous discoveries. It is widely agreed that globally as a body of horse practitioners we still don’t know what we don’t know and even more importantly, what we need to know to improve equine welfare during handling, training, performance and leisure. Often we forget the true heroes, that is, those who have gone before upon who’s ‘shoulders of wisdom’ we have built our equestrian and equitation practice, which may or may not include enjoyment and/or achievement as a result. Examples of these could go as far back as Xenophon – who wrote about foundation training in young horses making key statements such as “The groom should stroke or scratch the colt, so that he enjoys human company, and should take the young horse through crowds to accustom him to different sights and noises. If the colt is frightened, the groom should reassure him, rather than punish him, and teach the animal that there is nothing to fear.” This basic advice resonates in Equitation Science based approaches being taken to young horse education today. Although there are also teachings within Xenophon’s book that are no longer considered acceptable (and certainly not in the interests of good equine welfare), the introduction of habituation to frightening things, the use of reassurance rather than punishment and the introduction and acceptance of positive emotions in horses (such as enjoying human company) are now all active and growing areas for research in the established field of Equitation Science.

Most scholars are well aware of the valuable contribution made by the researchers who have preceded them. Although a relatively young discipline, Equitation Science has certainly benefited from the seminal work contributed by influential intellectuals and practitioners from various domains including animal welfare scientists and horse professionals. As the International Society for Equitation Science has come of age and is moving into its second decade, it is important to acknowledge the great work that has gone before us. At a practitioner and lay person level it is always worth remembering that lessons can be learnt from both early and current practitioners who may not have known, or know, about the ‘science behind their practice’. Such practitioners can provide valuable insights in the development of rigorous approaches to horse management, handling and training practice that can be robustly tested using an evidence-based approach. It is clear then, that in moving forward, we also need to look back to recognise the learning and inspiration gained from the early ‘Giants’ whose work we have drawn upon to provide some of the foundations of the work that will be presented at this conference.

ISES Honorary Fellows are individuals who have been formally recognised as active educators, researchers and/or practitioners and for their previous and ongoing work in the field of general animal welfare, particularly equine welfare. The aim of the Standing on the Shoulders of Giants
workshop is to find out who these ISES ‘Giants’ consider as their personal Equitation Science Giants. Each ‘Giant’ identified will be described highlighting reasons for their choice based on what they have provided in the way of foundation knowledge and how they have brought about improvements in equine-related practice, and equine welfare in particular. This workshop activity will enable conference delegates and indeed anyone with an interest in equids and their welfare, to gain a deeper appreciation of the history of human–horse and horse–human interaction.

Workshop participants will have the opportunity to discuss the various choices introduced by the panel of Honorary Fellows/speakers present and to discuss and debate the value of the contributions made by the identified potential ‘Giants’. They will then be asked to choose for themselves the three key ‘Giants’ that they feel have had the greatest influence on equine welfare, equitation practice and the areas studied by Equitation Scientists to date.

Lay person message: Globally as a body of horse practitioners we still ‘don’t know what we don’t know’, and even more importantly what we need to know, to improve equine welfare in relation to handling, training, performance and leisure. Lessons can be learnt from both early and current equitation practitioners, who may not have known, or know, about the ‘science behind their practice’ which now, thanks to the emergence of Equitation Science as an academic discipline, can be used to develop reliable evidence-based approaches to horse training, hence improving equine welfare and human safety. This workshop will examine the contribution of a range of ‘Giants’ identified by key Equitation Scientists.

Keywords: Equitation Science; Equine; Horse training; Safety; Welfare
Equine behaviour and welfare
Body language is an important means of communication between individuals. Particularly for social species, and this includes humans, body language constitutes a significant kind of communication. Despite the fact that the messages are mostly sent unconsciously, the meaning of them is something that must be learned. Under natural conditions the learning mainly occurs in the juvenile period, in the process called socialisation. Obviously, the more socialised an animal is and the better it understands the body language of its conspecifics, the stronger the cohesion of the group is. Communication through body language also occurs between species, particularly in predator–prey interactions and in human–animal interactions. Animals living in frequent contact with people learn to read their body language, something that, obviously, plays a large role in domestic animals. Similarly, people that have frequent contact with animals learn to read their body language. Experienced animal trainers communicate to a large extent through body language.

As in other types of communication, body language communication consists of exchange of information between a sender and a recipient. In the sender, the neurobiological basis for body language is due to the fact that the thought alone of performing a known action will activate the motor neurons used for the action, resulting in a slight contraction of the involved muscles. That the thought, or an idea, alone can stimulate muscle contraction has been called the ideo-motoric effect. In ethology, the minute muscle contractions are called intention movements. For instance, slightly before the bird takes off in flight it is possible to observe tension in its wing muscles. Observing an intention movement a few times will teach the recipient of the information what the sender will do within the next second. In this way intention movements may become ritualised and form the basis for body language. In other words, the intention movement causes a certain expectation in the recipient, enabling this individual to react. For example, if a horse wants to defend its food from another horse it may turn its head towards the approaching horse, lay down its ears and, possibly, lift one hind leg slightly. The message is clear: stay away. If the recipient of the message has learned its meaning, in other words if it is properly socialised, it will yield and a direct fight is avoided. Consequently, since living in a social group is the best way to ensure proper horse welfare, a prerequisite is that the group members learn the language of communication through socialisation.

Under domestic conditions, our interaction with horses through body language is equally important for many reasons. First, learning the body language of horses is important for safety reasons. For instance, if a horse is unwilling to be led somewhere it may turn away and run off, a reaction that may easily result in an accident. Paying attention to its body language, however, it is possible to see that, before turning away the horse starts its reaction by turning its nose slightly. If at that moment its head is turned back, its attempt to escape can still be stopped. Second, communicating through body language, a trainer or a rider may signal his or her intentions to the horse, making it easier for the horse to learn or to react correctly. Knowing which way to go when leading or riding a horse will indicate the way to the horse so that it is more likely to follow. Third,
body language may also influence results of scientific studies. Research on preferences or cognitive abilities in horses often use choice experiments combined with operant conditioning. In some cases, however, appropriate control procedures are missing, possibly giving rise to misleading results. Recent studies have thus demonstrated that horses prefer bigger quantities of food than smaller quantities, that they have prospective memory, and that they can communicate with people using symbols. These results may be true but because the experimental horses are handled by people right before or while they make their choice it is not possible to tell whether their choice is their own or whether it has been influenced by the body language of the handler. To be valid, this kind of experiment must eliminate any possibility of human influence which means that, while the experimental horse makes its choice, it should not be able to see any people. In conclusion, the more we are aware of the importance of our body language as well as that of our horses, the easier and safer our handling and riding them will be.

**Lay person message:** To a large extent, horses communicate with each other through body language. Horses living in close contact with people readily learn to read their body language and experienced horse trainers learn to read horses’ body language. This paper describes the biological basis of body language, both in the sender and in the recipient of the information exchange. It gives examples of how it is safer to be around horses when we pay attention to their body language, how we may improve training of horses by being aware of our own body language, and how our body language may affect scientific results.

**Keywords:** Equine; Body language; Ideo-motoric effect; Communication; Safety; Handling
Researchers in Equitation Science, as well as practitioners, constantly refer to horse behaviour. However, there is currently no gold standard for nomenclature and definitions of equine behaviour units. Therefore it is crucial that every study or application that measures behaviour of any kind, includes clear definitions of those behaviours in its protocol. The ultimate goal of an ethogram for a particular species is to provide an almost exhaustive list of behaviours and their function. However, agreement on function, causation or ontogeny is difficult to reach without accurate and widely accepted descriptive definitions of the various behaviour units. The availability of a descriptive reference ethogram for horses would increase the validity, reliability and compatibility of studies, allowing more efficient meta-analyses, without compromising the flexibility needed in individual studies and applications. A test of the feasibility and reliability of such a descriptive reference ethogram for horses was conducted using a test panel comprising 13 Equitation Science researchers and 10 high-level practitioners (veterinarians, riders, trainers, judges, horse welfare organisation staff). Panel members participated voluntarily and their responses were treated anonymously. Panellists were asked to score behaviours in 30 short video clips, using a partial ethogram with descriptive definitions. The ethogram provided contained 21 behaviours, including locomotor behaviours, lying down, getting up, rolling, striking and kicking. Separate movements of head, neck or tail and vocalisations were not included. Statistical analysis of the results using logistic mixed models indicated that the variability between observers was very low (covariance parameter estimate <0.0001) and much lower than the variability between video clips (covariance parameter estimate = 0.15, standard error = 0.05), indicating a high reliability. Scoring by researchers and practitioners showed no significant difference (p = 0.74). Participants in this pilot study received minimal training but were given access to 5 demonstration video clips with explanations and instructions on how to score the clips. It would be useful to investigate the influence of more specific training on the reliability of an ethogram. Feedback from panel members will be included in the ongoing development of the descriptive reference ethogram for Equitation Science. Ethograms and the behavioural definitions that they contain represent measuring units for behaviour. This study showed that agreement on descriptive definitions is possible. Optimising validity and reliability will not only increase the quality of Equitation Science research but also improve communication amongst stakeholders.

**Lay person message:** Interpreting horse behaviour is fundamentally important for everyone who works with horses. However, in order to explain why horses show particular behaviours, we must first agree on what we are actually observing. A reference ethogram, comprising a list of behaviours with clear definitions, will help researchers and practitioners to work together. An ethogram was developed and tested by 23 international experts. This study confirmed that clear descriptions of behaviours can be used reliably and equally well by practitioners and researchers alike.

**Keywords:** Reference ethogram; Behaviour unit; Descriptive definition; Reliability
DECREASED EYE-BLINK RATE AS A NON-INVASIVE MEASURE OF STRESS IN THE DOMESTIC HORSE

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Stress is a commonly used indicator of welfare and may be assessed using behavioural and physiological indicators, but behavioural measures can be subjective and obtaining physiological data can itself be stressful and intrusive. Eye-blink rate (EBR) has been successfully used as a non-invasive measure of stress in cattle and humans, and the objective of this study was to validate this measure in horses. It was hypothesised that EBR would decrease in response to the known stressors of (1) separation (SEP) – horse removed from visual contact with its paddock mates; (2) feed restriction (FR) – feed withheld at regular feeding time; and (3) startle test (ST) – a ball suddenly thrown on the ground in front of the horse while alone in the arena. Each of 15 horses were evaluated in random order in each of the three treatments plus a control (CON) – horse in its normal paddock environment. Heart rate (HR; bpm) was monitored every 5 seconds throughout each 3-minute test to correlate physiological changes with behavioural changes. Movements of the right eye (full eye blinks, half eye blinks and eyelid flutters) and behaviours (ear orientation, head height, lip movement and general restlessness) were retrospectively determined from video recordings. A one-tailed GLM mixed-model procedure with Sidak’s multiple comparisons of least square means demonstrated that both full blinks (3.0±0.43b vs 4.3±0.66ab vs 3.8±0.61a vs 6.2±1.16a full blinks/min±SEM in, SEP, FR, ST and CON respectively where a,b differ, F(3,39)=4.83, P=0.006) and half blinks (8.7±0.97bc vs 11.5±1.22ab vs 7.1±0.95c vs 12.9±1.31a half blinks/min±SEM in, SEP, FR, ST and CON respectively where a,b,c differ, F(3,39)=8.99, P<0.0001) decreased during potentially stressful situations. However, eyelid flutters were significantly more frequent in FR than any other treatment (1.3±0.36b vs 4.2±0.69a vs 1.3±0.44b vs 1.3±0.22b flutters/min±SEM in SEP, FR, ST and CON respectively where a,b,c differ, F(3,39)=8.76, P<0.0001). FR elicited more restlessness (F(3,37)=7.52, P=0.0005) and lip movements (F(3,39)=12.59, P<0.0001) than any other treatment. Horse HR increased with FR (44±13.3 a bpm±SEM) but decreased in SEP (37±6.6c bpm±SEM) and ST (37±8.1c bpm±SEM) compared to CON (39±7.8b bpm±SEM where a,b,c differ, F(3,4069)= 297.26, P<0.0001). These preliminary results suggest that a decrease in full and half blinks concomitant with an increase in eyelid flutters can be used as indicators of stress. EBR can be used as a non-invasive measure of stress in horses in conjunction with other behavioural indicators, allowing insight into a horse’s affective state.

Lay person message: Eye blink rate (EBR) has been used as an indicator of stress in cattle and humans. Horses exposed to stressful situations such as separation from herdmates, denied access to feed and sudden introduction of a novel object showed a reduced amount of full and half eye blinks along with an increase in eyelid flutters compared to horses in their normal paddock. Eye blink rate may have potential as a measure of stress in horses.

Keywords: Eye blink; Rate; Stress; Behaviour; Heart rate
THE EFFECT OF TONGUE-TIE APPLICATION ON STRESS RESPONSES IN RESTING HORSES

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Tongue-ties (TT) are commonly applied to racehorses to increase control by preventing the horse’s tongue from going over the bit, and as a conservative treatment for respiratory conditions, principally dorsal displacement of the soft palate. This study investigated horses’ responses to TT application in horses at rest using both behavioural (head-tossing/shaking, ear position, mouth-gaping and lip-licking) and physiological (salivary cortisol concentrations, eye surface temperature and heart rate) indices. Twelve Standardbred horses (six of which were naïve to TT) were used in a randomised cross-over design comprising two treatment groups: Tongue-Tie Application (TTA), and Tongue Manipulation (TM). The study comprised 3 phases: Phase 1 (Baseline), Phase 2 (Treatment) and Phase 3 (Recovery). In TTA, a commercially available elastic tongue-tie was looped around the tongue and then the mandible for 20 minutes during Phase 2. TM incorporated 30 seconds of manipulation of the tongue (without applying the TT) at the start of Phase 2. Behaviours and heart rate were recorded throughout the study. Saliva was sampled at the end of each phase for subsequent cortisol assays and infrared thermograph images were taken of each eye at 5-minute intervals. Statistical analyses were performed in SPSS using linear mixed effects models and repeated measures general linear models, to determine differences within treatments over time. Compared to TM, there was more head-tossing/shaking (26\% \pm 3.7\% vs 0.6\% \pm 0.2\%, P<0.001), backwards ear position (74.7\% \pm 4.6\% vs 9.3\% \pm 2.7\%, P<0.001) and gaping (58.2\% \pm 3.4\% vs 0.0\% \pm 0.0\%, P<0.001) during TTA in Phase 2. Horses with previous experience of TT showed more head-tossing (26.7\% \pm 5.6\% vs 16.0\% \pm 3.6\%, P=0.040) and gaping (58.1\% \pm 2.6\% vs 48.9\% \pm 4.3\%, P<0.05) than naïve horses. Lip-licking was more frequent after TTA treatment than after TM during Phase 3 (32.9\% \pm 4.1\% vs 3.8\% \pm 1.40\%, P<0.001). Compared to TM, salivary cortisol concentrations increased after TTA (1846.1pg/mL \pm 478.3pg/mL vs 1253.6pg/mL \pm 491.6pg/mL, P<0.05). Mean heart rate and heart rate variability and mean right and left eye temperature did not differ significantly between treatments in any phase (all P> 0.05). The findings suggest the application of tongue-ties causes changes to both behavioural and physiological parameters suggestive of a stress-related response. Further research is needed that will enable racing and sport horse regulatory bodies to make informed decisions about the appropriate use of tongue-ties in horses.

Lay person message: Tongue-ties are used to increase control over racehorses and improve airflow. Tongue-ties were applied to horses for 20 minutes and behavioural and physiological changes were detected suggestive of a stress response. Further research into the appropriate use of tongue-ties in horses should establish whether the costs to the horses, when wearing TT, are offset by the benefits to the horses and other stakeholders.

Keywords: Horse; Tongue-tie; Behaviour; Cortisol; Stress; Welfare
BEHAVIOURAL, CLINICAL AND RESPIRATORY RESPONSES TO 8-HOUR TRANSPORTATION IN HORSES

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This study documented the effects of transport on behavioural, clinical and respiratory parameters in horses identifying possible associations between them. Eleven horses with experience in travelling were subjected to 8 hour transportation without food and water. Clinical examination, respiratory endoscopy with tracheal wash (TW) aspiration and venous blood collection was performed before and after the journey (AJ). TW were submitted for bacteriological evaluation. Horse behaviour en route was recorded using an ethogram during the first 25 minutes of each hour of the journey and the 25-minute rest stop. Transportation caused a significant increase in cortisol and creatine kinase and activated an acute phase response with neutrophilia, hyperfibrinogenaemia and hyperglobulinaemia (F=21.982, num-df=3; den-df= 30, P<0.05). Transportation resulted in an increase in the proportion of neutrophils in TW, tracheal mucus and TW bacterial concentration, along with reduced bacterial diversity due to an increase in Pasteurellacea (all, P<0.05). Journey stage (from 1st to 8th hour) had a significant effect on horse behaviour. The frequency of stress-related behaviours (including licking or chewing, putting the nose outside and touching the rubber tie cord) was greatest in the first hour of travel and tended to decrease as the journey progressed (F=11.91, num-df=7, den-df= 70, P<.0001). Total balance-related behaviours (including leaning on stall rails, loss of balance, movement in any direction) decreased until the 5th hour of the trip before increasing to its peak during the 8th hour (F=3.11, num-df=7, den-df= 70, P=0.006). The amount of time spent in a head down position increased during the journey (F=6.25, num-df=7, den-df= 70, P<.0001). Horses that lowered their heads for less time and showed more stress-related behaviours had higher physiological stress and inflammation markers, increased tracheal mucus and higher TW bacterial concentration AJ (all R² >40 and P<0.05). Before the journey 6 of the 11 horses proved to have higher tracheal inflammation scores (ordinal regression analysis, estimate= -4.99, P=0.017). These horses had abnormal lung auscultation AJ, an overall higher concentration of bacteria in their TW (t=2.07, df=25, P=0.013) and an increased percentage of neutrophils in TW at five days AJ (t=4.11, df=27, P=0.003) in comparison to the other transported horses. The findings confirm that transportation is a stressful event for horses and there are demonstrable associations between behaviour during transport and health outcomes. While transport-related health problems are multi-factorial, scoping before journey, clinical examination including auscultation before and after journey,
behavioural observation during transport may provide insights into horses at elevated risk of transport associated respiratory diseases.

**Lay person message:** Transportation may cause health problems in horses. This study was conducted to examine the relationship between behaviour during transport and the occurrence of respiratory inflammation. Horse behaviour en route predicted clinical and respiratory outcomes. This study demonstrated that horse behaviour whilst travelling may be a useful indicator of poor health and welfare, and should be used to identify horses suffering from a high level of stress during the journey and subsequently at increased risk of transport-related respiratory disease.

**Keywords:** Transportation; Horse; Welfare; Behaviour; Respiratory disease; Health
Timing of the reward is very important in training horses and other animals. When an animal performs the correct response the reward should be provided in a very short time span of only a few seconds. Incorrect timing can lead to confusion and deleterious behaviours, and learning will be impaired. Clicker training can be used as an important tool. In clicker training, the ‘click’ (known as the secondary reinforcer) is sounded at the moment of the occurrence of the correct behaviour and the food (the primary reinforcer, the reward) is delivered some time later. The optimal timing between the secondary and primary reinforcer has not yet been determined in the scientific literature. The aim of this study was to investigate whether there is a difference in learning a simple behavioural task where the secondary reinforcement is followed by the primary reinforcement immediately, with a 10-second delay or with a 20-second delay. Fifteen horses were randomly allocated to three treatment groups where they were trained to touch a target using clicker training. Group 1 (n=5) was immediately rewarded after the click, group 2 (n=5) was rewarded 10 seconds after the click and group 3 (n=5) was rewarded 20 seconds after the click. All horses received a maximum of 20 training trials, with a maximum duration of 60 seconds per trial. When the horse touched the target with its nose 10 consecutive times, achieving the training criterion, training trials were stopped. Measurements were taken of the amount of time it took the individual to touch the target per training trial and number of touches. A Kruskal–Wallis pairwise test showed a significant difference in learning a simple behavioural task between groups 1 and 2 ($H_2=−31.955, P<0.05$) and between groups 1 and 3 ($H_2=−44.819, P<0.05$). There was no difference found between groups 2 and 3. Most horses from group 1 (n=4, 80%) reached the training criterion, two from the five (40%) out of group 2 reached the criterion and only one from group 3 (20%) reached the criterion. The results of this study suggest that immediate delivery of primary reinforcement is most effective and that as the time increases between the delivery of the secondary and primary reinforcers, learning efficiency declines. These results confirm that timing is an important contributor to the efficacy of secondary reinforcement, and that more research is needed to investigate secondary and primary reinforcement intervals of less than 10 seconds.

**Lay person message:** The timing between response asked for and delivery of the reward is very important in the training of animals and the gap should only be a few seconds. This study investigated the time span between the clicker and treat and revealed that the closer the timing between delivery of the click and the reward during clicker training the better the results.

**Keywords:** Clicker training; Learning theory; Horse; Reinforcement; Timing; Welfare
A CODE OF WELFARE FOR HORSES AND DONKEYS: ESTABLISHING STANDARDS FOR THE WELFARE OF EQUIDS IN NEW ZEALAND

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The Animal Welfare Act (1999) is the primary legislation relating to the care of animals in New Zealand and requires that owners and persons in charge of animals provide for their physical, health and behavioural needs. The Act allows for the development of codes of welfare by the National Animal Welfare Advisory Committee (NAWAC). The codes of welfare provide, in more detail than the Act, the requirements that people need to meet to care for their animals. When developing a code of welfare, NAWAC is required under the Act to take into account good practice and available scientific knowledge, as well as public opinion and any other matters it considers relevant. A new code of welfare for horses and donkeys was issued by the Minister for Primary Industries in 2016. This code applies to all horses, ponies, donkeys and hybrids of these in New Zealand, including those kept as companions, for breeding, sport, entertainment, those used as working animals and any horse captured from the wild. The code contains 15 minimum standards that people in charge of horses and donkeys must meet and includes standards relating to equine management, food and water, shelter, housing and facilities, restraint and containment, behaviour, handling and training, equipment, breeding, foaling and weaning, identification, health and emergency humane destruction. Minimum standards have legal effect – failure to meet a minimum standard in a code can be used as evidence to support a prosecution for an offence under the Act. Conversely, a person who is charged with an offence against the Act can defend themselves by showing that they have met or equalled the minimum standards in the code of welfare. The Act was amended in 2015 to allow for the development of animal welfare regulations. Regulations, in contrast to minimum standards, are directly enforceable and associated with fines and infringements. Regulations pertaining to the care and management of horses, and surgical procedures performed on horses, are currently being developed. These regulations are also based on good practice and available scientific evidence and the direct enforceability of these regulations are intended to further improve the welfare of horses and donkeys in New Zealand. The equine industries are also becoming increasingly aware of the public scrutiny directed towards ensuring the welfare of horses competing in events such as horse racing. Proactive non-legislative initiatives that are intended to improve welfare in equine sport in New Zealand will also be discussed. New Zealand’s regulatory system relies heavily on scientific evidence in order to guide appropriate standard setting to ensure that people meet the physical, health and behavioural needs of their horses.

Lay person message: The code of welfare for horses and donkeys was developed by the National Animal Welfare Advisory Committee and issued by the Minister for Primary Industries in 2016. The code contains minimum standards that owners and persons in charge of horses and donkeys in New Zealand must meet. An amendment to the Act was made in 2015 and allows for the development of animal welfare regulations, which are directly enforceable and intended to further improve welfare. Non-legislative industry initiatives are also envisaged to improve the welfare of horses in equine sport.

Keywords: Horse; Donkey; Legislation; Welfare; Code; Standards
Numerous factors affect horse learning. In this study data were obtained from horses (n=96) that were trained to step back in response to bit pressure – a simple, negatively reinforced, locomotory task. Owners were surveyed a week before the test. Factors from three broad domains were studied using a multiple logistic regression model to examine associations and learning outcomes. Intrinsic horse factors such as breed, age and sex were explored. The horses’ behaviour and training, with a focus on behaviours indicative of conflict, was also investigated, during both ridden and ground work sessions and included horse responsiveness to cues. Management-related variables were added to the model with estimates of the rider’s ability and experience and owner’s perceptions of their horse’s trainability and temperament. In the analysis, candidate models were ranked according to Akaike’s Information Criterion (AIC), expressing ability to predict rate of learning with the least number of model parameters. The influence of the various factors on the ability of horses to learn to step backwards through a corridor in response to bit pressure cues was assessed. Four left- and four right-hand trials were carried out. Preliminary results revealed a number of significantly correlated variables. Horses that rated highly on steering easily had similar ratings on stopping and going easily, as well as loading onto the trailer the first time. These four variables were combined in a cluster analysis to form each horse’s responsiveness-to-cues score. Responses to significantly correlated questions about frequency of tail swishing, ear pinning and bucking were also combined to describe general conflict-related behaviours exhibited by the horse. Other preliminary results indicate that a number of explanatory variables significantly influence rate of learning, as measured by the relative latency to back through the corridor over the course of trials. Horses were faster at backing through the corridor when handled on the right (t=3.65, d.f.=94, P<0.001). Horses that were in regular work did not learn faster than their unworked counterparts or manage to complete the backing task with more speed (F=1.96, d.f.=6, 85, P=0.08). Horses regularly ridden by beginners showed the poorest learning (F=2.98, d.f.=6, 81, P=0.05), suggesting either less sensitivity to the cues applied in the trials or compromised learning ability. The findings of this study help to clarify how horse characteristics, training and management may influence learning and how they can be applied to optimise the effectiveness of training regimes.

Lay person message: It is possible that the way that horses are managed influences their learning ability. Owners completed a detailed survey about their horses’ ridden and in-hand behaviour, age, owner riding ability, frequency of handling, horse management and training history. The 96 horses were then trained to step backwards in response to bit pressure. Horses reversed through the test corridor quicker when handled on the right rein than on the left. Regular ridden work did not appear to improve horses’ rate of learning. Horses regularly ridden by beginners showed the poorest rate of learning.

Keywords: Learning; Horse; Management; Training; Temperament
ATTITUDES TOWARD THE APPLICATION AND USE OF BIOMETRIC HEALTH DATA IN EQUINE TRAINING AND CARE

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The goal of this survey was to identify a relationship between an individual’s role in the equine community (owner, trainer, caretaker, casual rider and competitive rider) and their attitude towards use of technology in the collection and application of biometric health data and the maintenance of horse health information. An advertisement for the online survey was placed on Facebook for 24 hours, targeting likely respondents in the United States. The survey questions sought to determine whether community members collected health data independently. The survey also included questions regarding a community member’s attitude about the use of technology, asking for an indication of whether they would use technology to monitor health data or maintain health data records. In order to gauge whether or not respondents had a reason to collect such data, the survey also asked if there had been a medical incident in the last year that required monitoring heart rate, temperature or respiratory rate. Respondents (n=74) frequently identified with multiple roles, with some combinations such as competitive riders and owners being common. The results showed that there was a relationship between an individual’s role in the equine community and their attitude to health data collection. In particular, a Chi-square test of the survey results showed dependence between a willingness to use technology to monitor horse biometrics and identifying as either a competitive rider (Chi²=10.334, d.f.=4, P<0.05) or a horse owner (Chi²=12.081, d.f.=4, P<0.05). No other demographic groups showed such dependence. The results also showed a relationship between likelihood to collect biometric data for training and care purposes outside of veterinary reasons and identifying as a competitive rider (Chi²=10.597, d.f.=3, P<0.05). Interestingly, no such relationship was shown with identifying as a horse owner. Analysis of the health monitoring questions found that most respondents were not likely to monitor heart rate (5.4%), respiratory (6.8%) or temperature (10.8%) unless there was a medical reason to do so. This may be because respondents were not aware of links between health and performance and biometric data. Overall, approximately two-thirds of respondents (50 out of 74, 67.6%) would be likely to use technology for care and training. The data also suggest that while individuals might not be currently maintaining health records, with the introduction of technology, they might be willing to start. The availability of accessible technology that allows easy recording of health- and performance-related information for individual horses will assist with communication between responsible personnel and contribute to the maintenance and improvement of horse welfare.

Lay person message: Biometric technology is used by human athletes, coaches and trainers to improve performance and reduce the risk of injury, but the use of such technology in horses is still fairly uncommon. This research investigates attitudes of members of the equine community (from casual and competitive riders to owners and trainers) about equine biometric data collection. Most people were willing to use technology if it was available, particularly those identifying as competitive riders or owners. Availability of easy-to-use technology for recording
information about horses’ health and performance is likely to help those responsible for horses to maintain and even improve their welfare.

**Keywords:** Owner; Attitude; Biometric data; Health; Record; Technology
FIELD TEST OF AN INSTRUMENT TO IDENTIFY YOUTH PERCEPTIONS OF EQUINE WELFARE ISSUES AMONG COMMON TRAINING PRACTICES

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Many studies have been conducted to explore the human factors affecting horse welfare; however, these studies have almost exclusively focused on adults. Youth account for a large number of participants in equine activities and the principles of horse care and management that they learn as youths will impact how they interact with horses as adults. To advance equine welfare it is important to understand the viewpoints and perceptions of all populations working with horses. Therefore, the aim of this study was to develop a reliable instrument to gather data in order to increase understanding of youth perception and awareness of what constitutes a compromise to equine well-being. Survey items related to the importance of common care and management interactions and who taught the youth each of those interactions were derived from a previously validated instrument. Additional items used videos selected from various public video sharing websites, and a five-point Likert scale measuring if the horse in the video was not distressed, slightly distressed, somewhat distressed, moderately distressed, or very distressed. A panel of six adults of varying equine experience reviewed and scored the videos to determine which videos would be in the final instrument. Videos were selected based on consistency of evaluation of distress by the panelists, and demonstration of a range of levels of distress for all video items. The survey was distributed to members of a youth (ages 8–18) horse club (n=23) at the beginning of a lesson on horse well-being. The youth had no previous specific education on horse well-being or welfare. The welfare assessment scale was found to be highly reliable (34 items; Cronbach’s alpha=.868). A one-way ANOVA was conducted to compare means of youth responses to the videos against the experts’ to check for consistency and found there was no significant differences (P>0.05) between the amounts of distress the youth detected compared to the distress identified by the panel. This study demonstrated that this instrument has potential use to analyse youth perceptions within equine welfare. This survey will be further tested with larger populations to determine its effectiveness as an assessment of youth perceptions of behaviours impacting horse welfare, and to determine if factors such as sex, use of trainers and equestrian discipline are correlated to perceptions of horse welfare.

Lay person message: Youth are a large part of the equine industry, and are often overlooked when researching horse welfare issues. In this study, a field test was conducted using a survey designed to identify youth perceptions of aspects important to horse welfare relative to freedom from fear and distress. Youth perceptions of fear and distress were consistent with those of experts for a variety of videoed horse–human interactions.

Keywords: Equine; Welfare; Fear; Distress, Youth; Perception
In equine training, the whip is considered an artificial aid used to communicate with the animal. Within the industry, it is common practice to either use the whip with a single stroke or two or three strokes separated by a few seconds. Furthermore, limiting the number or pressure of whip strokes on horses during competition has been at the centre of several rule changes across the world. For example, the Fédération Equestre Internationale states that a horse should never be hit more than three times in a row. However, this rule focuses on quantity rather than frequency of strikes to improve horse welfare. Are there potential negative repercussions to the horse as a result of these well-intended rule changes? When using negative reinforcement in training, the effectiveness of the outcome depends on the ability of the reward/release of pressure to occur contiguously with the performance of the desired behaviour. If the release is too soon, it could signal a reward for an undesirable behaviour. Therefore, a pilot study was initiated to determine if the frequency of whip strikes might have a negative impact on the training and welfare of the horse due to contradictory messages relative to operant behavioural responses. Nine horses were fitted with a halter and driving blinders and tapped with a whip on their hindquarters lightly and consistently. Three tapping treatments were administered with a frequency of 3 seconds, 1.5 seconds or under a second between taps, respectively, once per day. The behaviour selected to be reinforced was to move the hindquarters towards the whip. This behaviour was selected since normal training would never reinforce this type of response, so the likelihood that horses already knew the desired task was very low. During the shaping sequence, the first approximated response was reinforced by ceasing the tapping, and a new shaping sequence was started after 5 seconds. Horses performed significantly better ($\chi^2$: $P<0.05$) when the tapping was at a rate of less than a second between taps. Any frequency of a single stroke or above a second has the potential to reinforce an unwanted behaviour or to create a new aversive behaviour that could disrupt the training sequence. Finally when a horse fails to offer the proper response to the request of the whip, riders may increase the force rather than the frequency of the strike which could negatively impact the horse’s welfare.

**Lay person message:** New industry rules intended to improve horse welfare focusing on decreasing whipping frequency may actually go against the principles of operant training, specifically negative reinforcement. This may lead to ineffective training results and/or the occurrence of aversive behaviours. This pilot study emphasised the need to ensure that rules are objective and evidence-based.

**Keywords:** Whip; Rule; Operant; Negative reinforcement; Welfare; Horse
There is an increasing amount of research regarding equine training techniques and equipment exploring their physical, psychological and behavioural impacts on the horse. The rise of technology provides endless accessible information about horse training and management to the equestrian public. Information about attitudes and perceptions of equestrian communities regarding training practices, especially between different equestrian disciplines, can be elusive. This qualitative study focused on attitudes and perceptions of equestrian communities regarding specific training methods/equipment as reflected in an equestrian online discussion forum. Forum posts were selected for analysis due to their unobtrusive nature, which allowed for anonymity and candor regarding participant attitudes. Three specific discipline groups were analysed: Dressage, Hunter/Jumper and Western. Forum threads were filtered by three topic areas identified in Equitation Science literature as potential sources of compromised welfare in ridden horses: hyperflexion, spurs and nosebands. From these filtered groups, random posts were selected for thematic analysis (N=144). Thematic analysis identifies and examines patterns in data and was used to analyse the selected posts for commonalities. Prevalent themes amongst all three disciplines were welfare concerns within their own discipline, negative feelings towards competition judges/governing bodies for ‘rewarding’ unethical practices and justification for utilising certain practices or equipment. Specific to discipline, posts about hyperflexion in the Dressage group yielded themes of negativity towards judges, governing bodies and professional riders. The Hunter/Jumper and Western groups reflected themes of not identifying hyperflexion as a concern in their sport, negative feelings about dressage, while also justifying instances where they have utilised similar practices as necessary when a horse was misbehaving. The topics of spurs and nosebands yielded themes of negativity towards different disciplines, knowledge-deficit concerns and justification for practices within all three discipline groups. The Hunter/Jumper group specifically reflected a theme of no welfare concern and justification for practices in the use of spurs for ‘lazy’ horses. The Western group most reflected the theme of negativity towards dressage and the use of tight nosebands. Other topics also emerged thematically, including rapping, de-nerving, draw reins, martingales and tie-downs. This content analysis provided further insight into discipline groups’ similarities and differences regarding opinions of training practices and equipment use as potential detriments to horse welfare. Further implications include continuing inquiry in this area and using these findings for intentional education and communication with equestrian audiences.

Lay person message: Knowledge of equestrian communities’ opinions regarding horse training techniques and equipment is limited. Qualitative analysis of equestrian online discussion forums is a potentially untapped source of information on people’s thoughts about welfare issues. This study analysed online discussion posts in Dressage, Hunter/Jumper and Western forum groups for their attitudes on hyperflexion, spurs and nosebands. Analysis revealed similarities and differences in how these discipline groups perceived welfare issues related to these topics. This study can be used as a foundation for further research and to inform development of education and communication tactics with equestrian audiences.

Keywords: Online; Disciplines; Ethics; Training; Welfare; Equestrian
Ethical and welfare considerations in the equine industry
THE POWER OF COLLABORATION: IMPROVEMENTS TO SAFETY AND WELFARE IN RACING

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The hazards of horse racing are well known. In Australia and the United States (US), jockey fatalities have decreased by about 50% since the 1980s. Though only documented over the last couple of decades, racehorse fatality rates have remained relatively stagnant in Australia, but have recently seen a moderate decline in the US. Evidence-based changes to policy and practice, aimed at improving the safety and welfare of both horses and their riders, are required to further reduce fatality and injury rates.

Falling from a horse that has sustained a catastrophic musculoskeletal injury or sudden death is the most common reason for jockey injury or fatality. Thus the key to preventing the worst of jockey injuries is to protect the horses they ride. Epidemiological studies have identified an array of conditions that contribute to increased risk of racehorse injury and fatality. These include horse and race-level characteristics such as horse age, age at first start, horse sex, race distance, type and condition of track surface, and class of race. More readily modifiable factors related to management or training and racing programmes that are associated with fatality include increased high-intensity exercise, extended intervals of rest, previous unsoundness, medication usage and horse shoe characteristics.

These epidemiological studies have been made possible because of collaborative partnerships formed within and between academia, industry and government. As an epidemiologist, I have been involved in two of these partnerships – the California Racing Injury Prevention Program funded by the California Horse Racing Board (an independent agency of the State of California) in collaboration with the University of California, Davis and the California Animal Health & Food Safety Laboratory, and the Equine Limb Injury Prevention Program funded by Racing Victoria (industry), the Victorian Racing Industry Fund of the Victorian State Government and the University of Melbourne. These programmes have brought together veterinarians, epidemiologists, pathologists, biomechanical engineers and bone biology researchers to develop evidence-based strategies to prevent bone and joint injuries in racehorses. Such partnerships have mutual benefits involving exchange of information, sharing of resources, development of continuing education modules, and training of graduate students, veterinary residents, trainers, race-day officials and veterinarians involved in racing. The advancement in knowledge gained from these research activities has flow-on effects that will benefit the horse, rider and industry as a whole.

Improvements to racehorse fatality rates in the US have demonstrated the power of collaboration, with reductions attributed to restrictions on length of toe grabs on horse shoes, improvements to track surface, avoidance of claims, and changes to rules pertaining to the use of corticosteroids and other medications. There is therefore evidence to suggest that a reduction in racing injuries can be achieved by researchers working together to identify risk factors that can be modified; supporting agencies to provide raw data for analysis, benchmarking, and to monitor risks and their effects; and industry regulatory authorities best placed to implement recommended evidence-based changes. Buy-in from all parties is crucial. Strengthening these partnerships, even with the
different agencies’ agendas, will help us come together to help prevent racehorse injuries and their associated jockey injuries and costs.

**Lay person message:** The risk of injury to racehorses and their riders is high. Factors that increase the risk to both racehorses and their jockeys have been identified. Strengthening collaborative partnerships within and between academia, industry and government will increase the power to prevent racehorse and rider injuries and fatalities. Fostering these partnerships will then ensure that best practice policies are implemented.

**Keywords:** Horse racing; Collaboration; Injury; Prevention; Safety; Evidence-based
WE SHOULDN’T FEAR THE CONVERSATION: A HOLISTIC, ETHICS-BASED WELFARE ASSESSMENT OF THE THOROUGHBRED RACING INDUSTRY, FROM FOALS TO RETIREES

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Equine scientists are often asked their opinions about the ethicality and welfare status of the Thoroughbred racing industry. Using ethical framework assessments discussed by Heleski and Anthony in 2012 (‘Science Alone Is Not Always Enough: The Importance of Ethical Assessment for a More Comprehensive View of Equine Welfare’), we will work through an assessment of the Thoroughbred flat racing industry in the United States. We will holistically examine the industry and consider all life stages of the horse. The public cites the following as their primary concerns: breakdown rates, racing of 2-year-olds, whip use, race day medication and ‘throw away’ retirement horses, but there are counterpoints to many of these arguments. On the one hand, the racing industry likely needs to listen to public perception in some areas, e.g. whip use, where increasingly strong evidence shows it does not help horses run faster and is increasingly offensive to spectators. In other areas, such as the racing of 2-year-olds, evidence actually supports that connective tissue benefits from the early conditioning and rational racing commitments at that age. Increasingly, welfare scientists are asked to address issues of “what positive mental states can the animal experience?” Is it a good ‘quality of life’? Is it ‘a life worth living’? If we process the elements of an ethical assessment, we find evidence of many positive aspects of a Thoroughbred’s life. For example, in the majority of cases, Thoroughbred broodmares and foals live a life that is very horse-centric and attentive to the horse’s nature. The majority experience well over 12 hours per day of turnout, in social groups, with significant grazing opportunities. Health protocols tend to be state of the art. We will explore more deeply the public’s concerns about racehorse welfare, using scientific evidence where available. Conference delegates will be challenged to ethically assess each different life stage of a racehorse’s life and synthesise the sum total.

Lay person message: Public concerns regarding horse racing have increased over the past few decades. Horse people from other disciplines also cite equine welfare concerns. We will discuss the concerns point by point, providing scientific evidence where available. Positive aspects of the Thoroughbred industry will also be discussed. To conclude, a holistic ethical assessment of the Thoroughbred racing industry will be conducted.

Keywords: Thoroughbreds; Racehorse; Welfare; Equine; Ethics; Assessment
In 2009, 18-year-old rider Sarah Waugh died after falling from a horse that she was being taught to ride in New South Wales. Her death reinforced emerging concerns that Australia’s equestrian industry required improvements to risk management and safety. The Workplace Health and Safety (WHS) framework has provided effective risk management and accident prevention techniques in ‘high-risk’ workplaces, like mining, construction and road transport. However, the WHS framework has not been systematically applied to horse-related work and non-work contexts. One non-intrusive means of evaluating the applicability and effectiveness of applying a WHS framework to horse-related injuries in work and non-work contexts is to conduct a retrospective accident investigation of a past event. This paper presents findings of a systematic accident investigation of documentation related to Sarah’s death. Accident data that were critically analysed included coronial, police and pathology reports and witness statements provided by Sarah’s parents. Qualitative data analysis (QDA) was applied to each possible accident-causation factor; where it could be compared and classified as a failed WHS ‘Critical Safety Standard’. QDA was structured around the accident examination process of ‘root cause analysis’. Numerous systems and organisational failures were identified as contributing to Sarah’s death. Factors included a series of uncontrolled or unrecognised pre-events, latent conditions, various human factors and poor risk-management organisational decisions. In particular, we found five key areas contributing to Sarah’s death: (1) lack of adequate supervision, (2) no individual training programmes, (3) poor communication, (4) inadequate risk assessment and (5) numerous organisational failures comprising inconsistent WHS practices. These findings suggest that if any one of the causal factors had been removed from the sequential accident timeline or improved Sarah might be alive today. Our case study suggests that combining a model of accident investigation (what happened) with Workplace Health and Safety (WHS) ‘Critical Safety Standards’ (what should happen) is not only beneficial for accident investigation; it can identify future avenues for improving horse-related safety and reducing adverse incidents. However, further empirical research in Equitation Science is required to determine if and what equestrian safety controls have the greatest impact on mitigating risk during human–horse interactions, together with research in Equestrian Social Science to ensure uptake by those interacting with horses.

**Lay person message:** This study used accident investigation techniques to analyse a high-profile equestrian fatality in Australia. Five factors contributing to the death of Sarah Waugh in 2009 were identified. These were (1) lack of adequate supervision, (2) no individual training programmes, (3) poor communication, (4) inadequate risk assessment and (5) numerous organisational failures comprising inconsistent WHS practices. These findings suggest that if any one of the causal factors had been removed from the sequential accident timeline or improved Sarah might be alive today. It is suggested that horse-related fatalities in work and non-work contexts can be reduced through industry collaboration, regulation, and the united presence of cohesive safety standards.

**Keywords:** Health; Safety; Fatality; Risk management; Accident investigation; WHS
THE ROLE OF HEART RATE MONITORING TO ASSESS WORKLOAD DURING MAINTENANCE INTERVAL TRAINING IN NATIONAL HUNT RACEHORSES

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Quantitative assessment of racehorse fitness levels achieved through heart rate monitoring (HRM), an established reliable indicator of workload, can aid trainers in formulating evidence-based training regimes and can be used to evaluate individual horses’ progress. Despite this, HRM is not used consistently within racehorse training. This study aimed to evaluate how the maintenance workload of racehorses actively engaged in training and racing in the UK varied across an interval-training regime (6 weeks). Ten thoroughbred racehorses (age: 9.1±1.9 years) of mixed ability (British Horseracing Authority Official Rating (OR): 127.2±7.95; career winnings: £34774.6±21548.64) and experience in training (races undertaken: 25±12) were recruited for the study. Fine Equinity™ HR monitoring systems collected weekly HR data for each horse during a maintenance interval training session (speed: 9m/s) on a 3 furlong (0.38m) all-weather gallop (sand, rubber and wax mixture; 8cm depth). Maintenance workload levels were determined by the same experienced National Hunt trainer. A typical training session consisted of a warm-up to the gallop (1,000m) followed by a canter interval run (0.38km), after which horses walked 0.38km back to the start. This process was then repeated a further two times. Mean HR for each run and horses’ HR at the end of each piece of work were recorded. This was used to calculate the mean percentage of HR maximum (%HRmean) and HRend (%HRend) for each horse between canter runs for individual training sessions and across the 6-week period. A series of Friedmans analyses with Wilcoxon Signed Rank post-hoc tests (Bonferroni adjustment: P<0.01) examined if differences in %HRmean or %HRend occurred across the cohort and for individual horses. No significant differences in either %HRmean or %HRend were found at cohort level (P>0.05). This pattern was repeated for the majority of individual horses (80%; P>0.05). Two horses did record significant increases in %HRmean between run 2 and 3, but these were non-significant when the revised alpha value was applied (P>0.01). No differences in %HRend were recorded for any horses (P>0.05). Racehorse workload demonstrated no significant sequential increases within training sessions despite trainer perception that this did occur; for most horses run 2 represented the highest workload (1: 33%, 2: 47.5%, 3: 19.5%). For the majority of gallop runs (60%) horses worked at medium intensity (120–180bpm), within aerobic thresholds. However, for the remaining 40% they exercised anaerobically, exceeding the targeted maintenance workload. The results provide evidence that HRM can provide trainers with an accurate appraisal of workload during racehorse training. Increasing industry understanding of how HRM can be used to monitor fitness within training can enhance equine welfare by preparing horses appropriately for the demands of competition.

Lay person message: Monitoring racehorses’ heart rates during training can provide their trainers with an indication of how hard they are working. Despite this, many racehorse trainers do not use this technology. Assessment of 10 racehorses during weekly interval training to maintain fitness levels, over 6 weeks, found horses’ average workload did not change. Heart rates revealed horses were exercising at appropriate HRs to retain fitness for 60% of runs, however for the remaining 40% they were working harder than the trainer perceived. Monitoring heart rates could provide
trainers with a more accurate measure of workload than assessment through observation of exercise sessions.

**Keywords:** Training; Horse racing; Heart rate; Fitness; Equine; Welfare
IT’S ALL ABOUT THE SEX: PRECONCEIVED IDEAS ABOUT HORSE TEMPERAMENT BASED ON HUMAN GENDER AND HORSE SEX

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An online survey was conducted to explore preconceptions of horse temperament based on horse sex. The questionnaire used required respondents to allocate three hypothetical horses (a mare, gelding or stallion) to four riders – a man, woman and female and male child. Family members were described as equally capable of riding every horse and each horse was described as suitable for all riders. There were 1,233 survey respondents, 75% of whom were riders with at least eight years of experience. Binomial logistic regression revealed the girl had 2.5 times the odds of being allocated a gelding compared to the boy (F3,3696=221.6, P<0.001). Respondents were significantly more likely to allocate the stallion to the man and nearly 50% of participants did not allocate a horse to the boy even though they ranked rider sex as least important to their choice (F3,3696=208.52, P<0.001). Ordinal logistic regression revealed respondents were more than twice as likely to rank rider age as more important than sex, and were 1.3 times more likely to rank rider strength over sex (F3,2367=55.95, P<0.0001), indicating disconnections between horse allocation and reasoning. When asked to select a positive or negative descriptor from a series of nine paired terms to describe horse temperament, more respondents assigned geldings positive ratings on terms such as calm, trainable, reliable and predictable. Results for mares were less well-defined, with 74% of the respondents labelling them bossy although 93% also considered them safe, willing, trainable and as having a good attitude. The results for stallions were most variable. While 82% of respondents labelled them as difficult, 95% also considered them trainable. Although 80% described stallions as bossy, the same percentage of respondents regarded them as having a good attitude. Participants were also asked which horses were most suitable for three equestrian disciplines: show jumping, dressage and trail-riding. Geldings were preferred for trail-riding (71.8%), while both stallions and geldings were considered equally suited to dressage (42.1% and 42.6%). Again, geldings were preferred for show jumping (50.7%). The current findings indicate that respondents allocated favourable attributes to geldings and preferred them for equitation in general. Results were less clear for mares and logical disconnections were strongest for stallions. The results suggest that riders are entering the horse–human dyad with strongly biased, preconceived ideas about temperament based solely on the sex of the horse. This could have far-reaching implications for both training and welfare.

Lay person message: This study surveyed people online and requested them to assign three hypothetical equally well-trained horses – a gelding, stallion and mare – to four equally capable riders. Results from 1,233 respondents revealed contradictory logic and preconceived ideas of factors that are likely to influence the behaviour of both novice and experienced equestrians when encountering stallions and mares. This may have profound implications for training and welfare because horses regarded as difficult, dangerous or bossy, are likely to be treated differently from those regarded as calm, reliable and easy-going.

Keywords: Horse–human dyad; Gender; Stereotypes; Bias; Temperament; Welfare
Equine personality traits are of major importance to training success as well as equine welfare, but at present, suitable assessment methods for use in genetic selection are scarce. The aim of the study was to select the most suitable traits out of a variety of behaviour traits assessed experimentally during breed shows for incorporation into breeding horse evaluations. For this purpose, mature (n=48) American Quarter Horses and foals (n=198) were observed during various procedures as part of their participation in breed shows. A variety of behaviour traits considered to be relevant for ease of training or safety were recorded and evaluated using a linear scale ranging from −2 (e.g. complete absence of the behaviour pattern) to 2 (frequent occurrence of the behaviour pattern) by an experimenter and for a number of traits also by horse owners. Besides practical relevance, for a trait to be considered suitable for genetic selection variability between individuals must be present. Furthermore, highly correlated traits should be reduced to just one trait to avoid duplicate assessment of closely related qualities. Most traits deviated from a normal distribution (Kolmogorov–Smirnov: P<0.01), indicating that prior selection for these traits either at the genetic level in the population or at the phenotypic level among show participants might have already taken place (e.g. skewness for the distribution of the traits alertness: 1.7, sociability towards humans: 1.3, frequency of rearing: 2.1, standing still: 0.7, reaction to applause: 0.8, Kolmogorov–Smirnov: all P<0.0001). In contrast to behavioural reactions to measuring height at withers, which were normally distributed (p=0.05), the majority of horses showed very little reaction to measuring cannon bone circumference (skewness: 1.7) and girth depth (skewness: 3.8, P<0.0001). The latter procedures are similar to daily routine handling procedures and therefore may be less suitable for assessment. Evaluation of analogous behaviour aspects by the experimenter and the horse owners (e.g. overall temperament, rearing, bucking, kicking) showed no significant correlations (Spearman rank correlation coefficients: all P>0.05). Along with the fact that all owner-evaluated traits correlated significantly (P<0.05) with each other, this raises the question, whether owners’ assessment may have lacked precision, or if behaviour observed during the show is not a good reflection of behaviour tendencies in the home environment. Foals that were perceived as more ‘bright’ by the observers, carried their tail higher (r²₄₆=0.2, P<0.01), kept a larger distance from their dam (r₁₆₁=0.4, P<0.0001) and showed more exploration of the environment (r₁₈₄=0.2, P<0.001). Temperament correlated strongly with calmness (r₂₄₆=0.7, P<0.0001) and the overall impression during free-running (high-spirited, r₂₄₆=0.8, P<0.0001). In view of these results, a reduction of the number of traits to just a few of the most relevant and objectively assessable traits – such as reaction to measuring height at withers – appears to be justified. Ultimately, identification of, and genetic selection for, suitable behaviour traits might ease training and improve both equine welfare and human safety.

Lay person message: Selection of certain behaviour patterns appears to have already taken place in the population of American Quarter Horses. Many behaviour traits are closely related to each other, suggesting that fewer traits can be evaluated in the future. However, owners and observers
may interpret the behaviour of the individual horse differently and future investigations are required to show which evaluations are more valid.

**Keywords:** Personality; Character; Temperament; Human–horse interaction; Foal; Breed show
THE AUSTRALIAN EQUINE INDUSTRY

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Since the introduction of horses with the arrival of the first British Fleet in 1788, the equine industry has developed to be one of the top ten industries in Australia. The Australian equine industry includes a range of disciplines such as racing, dressage, eventing, show jumping, Pony Club, cutting, reining, stock work, polo, polo cross, drafting and pleasure riding. The industry is substantial in relation to its population of horses and its input to Australia’s economy contributing to an estimated 6.3 billion dollars of Australia’s gross domestic product.

Globally, there are few countries where the Thoroughbred has played such a significant part in the development of a national identity and culture as the racehorse in Australia. The Australian racing industry is unique and differs from its British origins with the emphasis on 2-year-old racing. Promoted as the world’s richest racing meet, the AAMI Golden Slipper race for 2-year-old Thoroughbreds is seen as the premier event of Australian racing. Whilst 2-year-old racing is an attractive investment for potential Thoroughbred owners, as the time lapse between purchase at yearling sales and racing is shortened, the physical demand on these young developing horses is intensified. These demands not only raise the expectation in the performance of the horse but also the standard of welfare, business and accountability of all involved.

Due to the high wastage rates in the horse racing industry, community concerns are increasing over animal welfare. These wastage rates reflect on the industry as a whole and in recent years the development of re-homing, re-training and rehabilitation centres has provided an avenue for retired race or performance horses into a new career, which may assist in a decrease in overall wastage. The implementation of these programmes and initiatives is designed to advance the welfare outcome for performance horses as the concept has been adopted well beyond Thoroughbred racehorses.

Lay person message: In recent years, the Australian equine industry has made vast progress in collaborating to address industry-wide issues. Animal welfare is a primary issue within the industry with public concerns over the health and well-being of all animals in all parts of the industry. The development of Equine Welfare Strategies throughout disciplines is designed to shape a culture in which the welfare and safety of horses is paramount. These strategies and associated codes of practice are developed through industry collaboration, extensive consultation with industry stakeholders and experts and are established to set strong objectives and priorities for the future. The introduction of these strategies may increase understanding of animal welfare requirements and have a positive change in an industry where horses are so ingrained in the nation’s culture and history.

Keywords: Industry; Welfare; Wastage; Equine: Economy; Culture
Equitation Science in practice: educating humans and horses
Equs Education (NZ) Ltd applies the ten ISES principles of learning theory to initiate foundation behaviour of foals for the racing industry. Over the past decade, 2,375 foals have been successfully educated in 18,000 training sessions without injury to foals or mares. The basic training is a collaborative process involving the mare and two handlers. Communication of an ongoing training programme for farm staff and other industry professionals is required to maximise the benefits of the method. Behavioural science validates the training process and communication with stakeholders facilitates change in practices.

Traditionally, the first handling of foals in New Zealand occurs at 4–6 months of age, as this is when the farm staff have time to work with them. A new approach allowed Equs Education (NZ) Ltd to work with much younger foals. Foals are trained for 6–9 sessions at 1–3-day intervals for about 10–30 minutes. They learn to be approached, haltered, touched all over, led and have their feet picked up by any experienced handler. In order to match a foal’s cognitive levels, training does not start earlier than three weeks of age. By synchronising training with the socialisation phase of the foal’s development, they are naturally looking to explore their environment and create new relationships, and there is less chance of interfering with the mare–foal bond.

The foals are habituated to the handler’s presence, touch and relevant environmental stimuli. They learn to be led by utilising social facilitation and by classical conditioning of cues. This is followed by operant conditioning of pressure variations of cues and tactile positive reinforcement. ‘Go’ is signalled by forward pressure on the halter. ‘Stop/slow down’ is signalled by halter pressure across the foal’s nose. A left movement with the handler’s hand cues a left turn and right movement a right turn. Handlers train one response per signal and minimise the number of signals. It is particularly important that a racehorse has highly developed social skills and understands different contexts of the same signal, as they subsequently need to perform with different horses, handlers, environments and states of arousal.

Between September and December 2016, data were collected on 65 foals learning to lead using the above method. All foals learnt the four cues within four training sessions. The median of total repetitions for a ‘go’ cue attainment from the nearside was 10.5 (range 6 to 19), from the off side 9.4 (range 5 to 16). The ‘stop’ response attainment from the nearside required 10.2 repetitions (range 6 to 16); and from the off side 9.0 (range 5 to 17).

A 2017 review of equine welfare during exercise included the statement that the horse’s aversion to the bit is “a significant welfare issue that should be addressed”. It is hoped that the foal training is a step towards addressing this need for the racehorse. If foundation training is established from three weeks of age and maintained by farm staff in ensuing months, it seems likely that the non-aversive training of halter cues when young will facilitate the introduction of non-aversive bridle cues for the future racehorse. Such an outcome would improve quality of life for a racehorse and this, in turn, would improve performance. A pilot programme is planned to test this hypothesis.
A foal’s subsequent racing career is underpinned by collaboration and communication with the many specialists who are integral to its overall success. Equus Education (NZ) Ltd continues to learn and share knowledge, as change can only occur if all parties concerned are committed.

**Lay person message:** Equus Education (NZ) Ltd uses learning theory to train foals for the racing industry. Foals learn to be approached, haltered, touched, led and have their feet picked up by any experienced handler. The method involves communicating and collaborating with mares, foals and staff. Foundation behaviours are trained using different contexts of the same signal to anticipate the variables of different handlers, environments and states of arousal.

**Keywords:** Learning theory; Thoroughbred; Foal; Behaviour; Training
A practical demonstration of an Equitation Science based method of handling/training for hoof handling will be provided. This method also engages with and encourages the owner/handler to read the horse’s body language and emotions, using a system that is safe, calm and efficient for all involved. Included are explanations of why some other training or restraining methods may not work for hoof trimming situations.

Hoof care providers are put in situations that are extremely dangerous and wearing to their bodies. Their job needs to be made as easy as possible. Many horse owners are ignorant of the situation and how difficult it is for their farrier/trimmer to carry out what should be a 20-minute procedure due to the behaviour of their horse. Many different actions are carried out every day across the world to try and get the hoof care job done. It is usually left up to the hoof care provider to provide a solution. These can include tying a leg up, twitching the horse’s top lip, sedation, hitting the horse, sending the horse away in a circle, restraining in a crush and many others. In the experience of Richard van Dijk, these methods adversely affect the horse, creating fear and confusion. Often they cause a more dangerous situation for all involved. The desired outcome is for a horse to be calm and comfortable and balanced. The science-based training techniques that Richard uses are safe, calm and easy to implement for all handlers. The horses learn quickly how to behave and there is no need for other methods of restraint or discipline.

Richard has identified three main scenarios in his hoof trimming business and the techniques vary according to which of those situations occur. The demonstration will detail how to deal with each scenario.

The demonstration of handling for hoof trimming is especially linked to conference aspects of putting Equitation Science into practice; body language and its importance when working with horses; equine welfare; assessing equines’ emotional state and influencing human change (train the human in the course of the hoof trim).

**Lay person message:** Close observation by the horse handler will reveal that there are various, sometimes very subtle, clues in the horse’s body language that precede it moving. Identifying and observing these and then acting immediately and knowing which action to take are the keys to preventing undesirable behaviour during hoof trimming. The specific action to take depends on what the hoof care provider is doing at the time and will range from a tiny movement of the hand on the halter to a series of ‘overshadowing’ movements.

**Keywords:** Equitation Science; Practice; Equine; Hoof trimming; Safety; Welfare
Measuring equine behaviour
Until recently animal welfare assessment traditionally relied on measures of physical health, and changes in behaviour and physiology related to negative emotional states such as pain and stress. However, it is now widely accepted that good welfare is not simply the absence of disease or negative experiences, but also the presence of positive experiences such as pleasure. Horses have historically had a close association with humans and this horse–human relationship has become increasingly described in subjective and anthropomorphic terms. This combined with the generally non-livestock status of the horse often precluding it from welfare-based scrutiny and the advent of training methods that encourage the human to mimic horse behaviour and roles such as that of the ‘leader’, has exposed horses to greater threat of inadequate assessment of their welfare. For every horse in the world that is subject to some form of formal welfare-based assessment such as part of a competition there are many others who are not and are therefore at risk of continuing inadequate welfare. To ensure horses experience optimal welfare it is necessary to understand what good welfare is from the horse’s perspective, how welfare can be assessed across a range of environments and equine uses, and what needs to be done to achieve improved welfare. This is particularly pertinent when considering horse–human interactions from the horse’s point of view. We consider the development of an ‘Equine Quality of Life’ (EQoL) framework essential for providing horse owners, riders and practitioners with an evidence-based instrument for assessing the overall life experience of a horse. In order to achieve this it is necessary to be able to appraise both the physical and mental well-being of a horse in relation to typical events and situations experienced during its working lifetime. Tinbergen’s ‘Four Whys’ have been used extensively as a framework for explaining animal behavioural responses, however their focus on proximate mechanisms and ultimate function often leads to the emotional significance of the animal’s response being overlooked. Described as the enigmatic ‘inner world of the subject’, the proposal by some scientists for Tinbergen’s questions to be extended to include the ‘Fifth Why’ is particularly relevant to the field of Equitation Science, not least because in some equestrian disciplines the demeanour of the horse is judged in competition – e.g. as evidenced in dressage rules relating to the ‘Happy Athlete’. Furthermore despite recent research into behavioural indications of negative mood states in animals (e.g. signs of pain and cognitive bias), a reliable method for objectively assessing equine mental state, including expressions of positive emotions, has yet to be developed. Physiological measures such as heart rates, although potentially providing objective evidence, have been found to reflect arousal level rather than emotional valence. There is currently no physiological measure that distinguishes between positive and negative emotions in the horse. In addition, behavioural signs do not always reflect
physiological responses. However, the additional dimension of motivation to approach or avoid, as a potential means of differentiating between positive and negative responses in some scenarios, as well as between fear and aggression may be easier to test behaviourally. Cognitive bias studies have been conducted in a range of species in order to determine if the animal has a ‘positive’ or ‘negative’ outlook depending on previous life experiences, but in some cases results are inclusive, casting some doubt on the overall reliability as a tool to assess emotion in non-verbal species. Cognitive bias studies have yet to be used successfully in equids. The identification of validated indicators of negative and positive emotions in the horse is critically important, since in the absence of credible evidence, it is likely that equine welfare will be compromised during training and performance. In this presentation the need for an EQoL assessment tool, the challenges that need to be addressed to provide an evidence-based assessment of equine emotional state and the behavioural, physiological and cognitive indicators that have potential, following further investigation, to underpin the development of an Equine Quality of Life (EQoL) framework are discussed. The characterisation of equine emotional response in terms of arousal level and valence, based upon validated equine-based indicators, could then be used to determine the impact of different situations and experiences on horses during their lives.

Lay person message: Welfare includes how a horse feels about the situation it is in. If we are to assess and then improve the horse’s experience of its life, we need to use validated animal-based measures of the horse’s mental state. This paper will describe various measures that have the potential to be incorporated into an Equine Quality of Life (EQoL) Framework to help horse owners and equine practitioners ensure that they provide for the emotional needs of their horses.

Keywords: Emotion; Mental state; Cognition; Behaviour; Equine Quality of Life; Welfare
This study assessed the negative welfare impacts of common interventions applied to horses and ponies across a broad range of contexts of care and training. A panel of veterinary and equestrian experts (n=16) met for a four-day workshop to assess these interventions, using an adaptation of the domain-based humaneness assessment model. The primary aim was to use a structured approach to explore whether the Five Domains could be applied to horses in different contexts.

The first four domains focus on internal disturbances due to nutritional, environmental and health-related problems (Domains 1–3) and on conditions that limit the animal’s capacity to express various behaviours (Domain 4). The interventions were considered within 14 contexts developed specifically for the current study: C1 Weaning; C2 Diet; C3 Housing; C4 Foundation training; C5 Ill-health and veterinary interventions (chiefly medical); C6 Ill-health and veterinary interventions (chiefly surgical); C7 Elective procedures; C8 Care procedures; C9 Restraint for management procedures; C10 Road transport; C11 Activity – competition; C12 Activity – work; C13 Activity – breeding females; and C14 Activity – breeding males. Scores out of 10 for Domain 5 (the mental domain) were compared before and after the workshop. The most severe (median and inter-quartile range, IQR) impacts within each context were identified as:

**Pre-workshop:**
- C1 abrupt, individual weaning (9, IQR 2);
- C2 feeding 100% low-energy concentrate (9, IQR 3);
- C3 both (i) outdoor tethering with no social contact and no shelter (10, IQR 1) and (ii) indoor tie stall with no social contact;
- C4 casting horse with ropes (7, IQR 3);
- C5 long-term curative medical treatments (6, IQR 3);
- C6 major deep intra-cavity surgery (8, IQR 2.5);
- C7 castration without veterinary supervision (10, IQR 1);
- C8 tongue-ties (9, IQR 5);
- C9 both (i) ear twitch (7, IQR 3) and nose twitch (7, IQR 3.5);
- C10 both transport in a group with unfamiliar companions (6, IQR 3.5) and (ii) individual transport (6, IQR 2);
- C11 both (i) jump racing (8, IQR 2) and (ii) polo competition (8, IQR 2);
- C12 rodeo horses (7, IQR 2.5);
- C13 broodmare in-hand matings (3.5, IQR 1) and C14 both (i) teaser horse (3.5, IQR 4) and stallion in-hand matings (3.5, IQR 4).

**Workshop:**
- C1 abrupt, individual weaning (10, IQR 1);
- C2 feeding 100% low-energy concentrate (8, IQR 2.5);
- C3 indoor tie-stalls
without social contact (9, IQR 1.5); C4 both (i) dropping horse with ropes (9, IQR 0.5) and forced hyperflexion (9, IQR 0.5); C5 long-term curative medical treatments (8, IQR 3); C6 major deep intra-cavity surgery (8.5, IQR 1); C7 castration without veterinary supervision (10, IQR 1); C8 both (i) tongue-ties (8, IQR 2.5) and (ii) restrictive nosebands (8, IQR 2.5); C9 ear twitches (8, IQR 1); C10 both (i) individual transport (7, IQR 1.5) and group transport with unfamiliar companions (7, IQR 1.5); C11 both (i) jump racing (8, IQR 2.5) and Western performance (8, IQR 1.5); C12 carriage and haulage work (6, IQR 1.5); C13 wet nurse during transition between foals (7.5, IQR 3.75) and C14 teaser horse (7, IQR 8). The workshop focused on reaching consensus on what assumptions must be made before applying the domains-based approach to welfare assessment. These will assist future endeavours that deploy this approach to assess the impact of husbandry and equitation procedures on horse welfare. Correlations between pre-workshop impact scores and workshop scores for Domain 5 were high (all correlations; P<0.0001) but some rankings changed after workshop participation, particularly those relating to breeding practices. Domain 1 had the weakest association with Domain 5.

**Lay person message:** A panel of horse welfare professionals met over a four-day period to assess 116 procedures to which horses can be subjected, across a range of 14 contexts, such as breeding and training. The panel estimated the impact of nutritional, environmental and health-related problems (Domains 1–3 respectively) and conditions that limit the animal’s capacity to express various behaviours (Domain 4) before considering how these four come together to have an overall impact on the horse’s mental state (Domain 5). Scores for Domain 5 (gathered during the workshop aligned well with overall impact scores assigned by the same panellists individually before the workshop but some rankings changed after workshop participation. The workshop created a series of assumptions about each intervention that future users of the same approach may make when assessing welfare.

**Keywords:** Horse; Welfare; Assessment; Equitation; Husbandry; Five Domains
THE EFFECT OF DIFFERENT BITS, BRIDLES AND REIN HANDLING ON REIN TENSION
AND MUSCLE TRIGGER POINT REACTION

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Muscular condition is considered to influence equine performance, however, interactions between equipment, rein tension and muscle trigger point reactions has not been investigated so far. The study aim was to investigate the effect of different bits, bridles, one- or two-handed rein handling and the horse’s muscle trigger point reactions on the magnitude and symmetry of rein tension in Western (W) and English (E) riding styles. Mean rein tension was measured in 65 riders and 88 horses in walk, trot, canter and gait transitions in both directions in E (n=46 rides) and W (n=61 rides) with either snaffle bits, curb bits or bitless bridles. For 11 rides (right-handed riders only) reins were held both bimanually and one-handedly with each hand. 28 muscle trigger points (irritable spots in the fascia surrounding skeletal muscles) were assessed bilaterally and categorised according to the reaction to manual pressure (reaction level 0–3, where 0=no reaction and 3=strong avoidance reaction). The difference between mean reaction level of each side was evaluated. Mixed-model analysis was used (F test throughout) for normally distributed mean tension and generalised mixed-model analysis for standard deviation (SD) and range of rein tension. Higher mean tension was detected in E regardless of bridle type (12.3±0.8N snaffle bits) compared to snaffle bits (6.1±0.9N) and in particular jointed (snaffle with shanks 3.9±1.9N, correction bit 2.8±2.2N) and fixed curb bits (2.6±2.9N) in W (F_{4,90}=13.7, P<0.0001). Mean tension differed for E (9.9±1 vs 11.7±1.1N) but not W (7.6±1 vs 7.3±1.3N, F_{8,90}=4.3, P<0.01) between single-jointed and double-jointed snaffle bits. Mean rein tension also varied between combinations of bits and bridles. It was lowest for French cavessons combined with curb bits (2.3±2.3N) and figure-eight nosebands combined with snaffle bits (4.5±2N) compared to other combinations of snaffle bits with different cavessons (No cavesson: 6.7±0.9N, French cavesson: 9.2±1.1N, drop noseband: 10.2±3.2N, flash noseband: 14.7±1.4N, F_{8,83}=6.2, P<0.0001). Right-handed riders with a left preference for holding the reins showed less asymmetry when riding with both hands (range: 2.2±0.3N left rein/2.2±0.2N right rein) compared to those with a right preference (1.9±0.3N left rein, 2.5±0.2N/ right rein, F_{7,406}=13, P<0.0001). Contact was less stable for the dominant, i.e. right hand (SD: 0.5±0.2N, P<0.05) compared to the non-dominant (left) hand (SD: 0.3±0.3N/right preference vs 0.2±0.3N left preference, F_{7,406}=2.3, P<0.05). Bimanual rein contact was less stable than one-handed rein contact (SD: 0.8±0.5N). Horses with stable rein contact as self-assessed by riders showed the most symmetric trigger point reactions (left–right difference 0.03±0.03, F_{3,93}=3.8, P<0.05). Left–right difference was asymmetric in horses ridden with ‘very instable’ rein contact (0.3±0.2). Horses carrying their tail to the left (0.2±0.7) showed less symmetric trigger point reactions compared to horses carrying their tail straight (0.08±0.06, F_{3,93}=3.6, P<0.05). Riding style, laterality of horses or riders and lateral displacement of the hindquarters did not relate to the symmetry of trigger point reaction (P>0.05). Bridles prohibiting jaw opening were associated with higher rein tension indicating possible welfare issues. One-handed rein contact appeared more stable and revealed a possible advantage of the non-dominant/left hand. Considering relationships between horses’ muscular condition and rein tension appears important for equine welfare and has the potential to add further knowledge to investigations of horse–rider interactions.
Lay person message: Rein tension was higher with English riding, snaffle bits and bridles prohibiting jaw opening compared to Western riding and curb bits. Riding one-handedly resulted in a more stable rein tension. The rider’s non-dominant left hand seemed more sensitive with rein handling than the dominant right hand. The horse’s muscular condition appeared to influence the stability of rein contact.

Keywords: Rein tension; Muscle trigger point; Symmetry; Bit; Bridle; Welfare
HORSES’ VOLUNTARY ACCEPTANCE OF REIN TENSION WITH VARIOUS BITLESS BRIDLES COMPARED TO A SINGLE-JOINTED SNAFFLE BIT

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In trying to use more welfare-friendly alternatives to conventional bridles, riders often resort to bitless bridles, but little is known about horses’ pressure sensitivity in the different body parts bitted and bitless bridles act on. The aim of the present study was to obtain information on how horses perceive the pressure exerted by various bitless bridles as compared to a regular snaffle bit. For this purpose, 21 leisure or riding school horses of various breeds (hot-blood types: n=4, warmblood types: n=14, cold-blood/heavy pony types: n=3; all usually ridden with a jointed snaffle bit) were each equipped in random order with the following headgear: LG-bridle®, Sidepull, Dr Cook’s BitlessBridle®, Fred Rai Rope® (similar to a Bosal), conventional rope halter, and a conventional bridle with a single-jointed snaffle bit. Reins were equipped with a Centaur rein tension meter fastened 10cm above the withers to an anti-roll bar of a girth to simulate the position of the rider’s hands and adjusted to a length that allowed the horse to hold the forehead 5-10 degrees in front of the vertical. Subsequently, horses were lured with food to encourage them to stretch horizontally-downwards against the reins, while standing in a stable. Testing was terminated when a horse had attempted to reach the food and subsequently released tension or after a maximum of 1 minute. This procedure was repeated for each horse and bridle type three times per day, and the entire trial was repeated for each horse on three subsequent days. A mixed-model accounting for the type of bridle, repetition (1st, 2nd, 3rd test day), horses' breed type and age (4–24 years, considered as a covariate) and adjusting for multiple comparisons using the Tukey test, was used to analyse maximum rein tension exerted by the horses in an attempt to reach the food. Cold-blood/pony-type horses applied significantly higher maximum (43.9±5.4N) rein tension compared to the horses of warm- (29.0±2.5N) and hot-blood type (28.6±4.7N; F2,336=3.26; P<0.05). Age and repetition did not influence (P>0.1) rein tension parameters. With the exception of the Sidepull (26.7±2.9N; F5,334=7.67; P<0.05), horses applied similar (P>0.1) amounts of maximum tension to all other bridles (32.4±2.9N – 38.9±2.9N), including the snaffle bit, although the Sidepull and the snaffle did not differ significantly from each other (P>0.05). Provided that horses receive equal levels of prior cue training, results indicate that with the investigated headgear except for the Sidepull, similar levels of rein tension may be required to produce a salient stimulus, and that the same amount of rein tension results in similar levels of discomfort in the horse. Compared to the other bridles, the Sidepull is equipped with a stiffer and thinner nose-band, resulting at equal levels of rein tension in higher pressures on the horse’s nose, which explains the lower threshold of maximally tolerated rein tension for this bridle.

Lay person message: Horses applied similar rein tension to bitless bridles such as the LG-bridle®, Dr Cook’s Bitless Bridle®, Fred Rai Rope® or a conventional rope halter compared to a single-jointed snaffle bit. This indicates that with the different types of headgear, the same rein aid is similarly aversive to horses, and at equal levels of prior training, signals of the same intensity are sufficient to produce a noticeable aid.

Keywords: Rein tension; Bitless bridle; Bit; Motivation; Pressure; Welfare
AN OPPORTUNISTIC PILOT STUDY OF RADIOGRAPHS OF EQUINE NASAL BONES AT THE USUAL SITE OF NOSEBANDS

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Restrictive nosebands are of growing concern because of their putative impact on equine welfare. An informal system for gauging noseband tightness has been to check if one can fit two fingers between the noseband and the horse’s nose. In 2012 the International Society for Equitation Science (ISES) developed a taper gauge to measure this space and standardise this assessment objectively. A recent European study revealed that 44% of all horses studied (n=750) (eventers, dressage and performance hunter horses) wore nosebands that allowed no space for the ISES gauge to be inserted between the noseband and the nasal plane. The aim of this current preliminary, opportunistic study was to evaluate archived radiographs of equine nasal bones for evidence of trauma such as bone deposition, bone lysis, changes in bone homogeneity, bone fractures or soft tissue swelling and to test whether age, sex or breed were risk factors for such changes. Radiographs of the nasal bones of horses (n=60) were studied by a specialist radiologist blinded to their signalment for any evidence of the described bony or soft tissue changes. Horses with described changes were classified as possible cases and horses without changes, non-cases. Possible cases (n=9) were discussed with a second specialist radiologist resulting in the reclassification by the first specialist of 3 possible cases as non-cases. The remaining cases (n=6) were matched to the signalment of each horse (age, sex, breed) by the first author and associations with being a case were assessed using chi-square tests and logistic regression analysis. Of the 60 horses assessed, 3 of 6 warmbloods, 2 of 18 Thoroughbreds and 1 of 5 stock horses were cases. The association with being a warmblood was statistically significant (p=0.006, P<0.01) with a 39.3 times greater risk of changes than other breeds. Cases were not significantly associated with sex or age. There was lack of consensus between the specialist radiologists as to whether some changes represented normal anatomical variation and/or radiographic artefact. However, the specialists agreed that assessing equine nasal bones using archived radiographs was surprisingly difficult due to issues such as inconsistent radiographic technique and equipment, obliquity of radiographs and a lack of objective data on what comprises normal nasal bones. Any further radiographic studies in this domain should consider using a prospective sample, establish consistent radiography protocols and aim to establish normality by studying a control population, such as Australian Brumbies, that have not had human interventions.

Lay person message: Although many riding manuals state that there should be a gap of two fingers between the noseband and the nasal plane there has been a recent trend to tighten nosebands much more than this. A specialist radiologist examined 60 radiographs of the front of horses’ heads at the usual site of noseband placement for any evidence of trauma. Changes were noted in 6 radiographs; 3/ 6 warmbloods, 2/ 18 Thoroughbreds and 1/ 5 stock horses.

Keywords: Tight; Noseband; Radiograph; Bone; Changes; Trauma
CHANGE

THEME: CHANGE

“An act or process through which something becomes different”
Human behaviour change within the equine industry
The welfare of recreational horses in developed countries has become an increasingly important issue, as evident by the high representation of horses in welfare investigations. A substantial proportion of horse welfare problems are reportedly due to horse owner mismanagement, as a result of ignorance rather than intentional abuse. An important determinant of domestic animal management and their ensuing welfare outcomes is the quality of the human–animal relationship (HAR). Furthermore, the most direct influence on intended human behaviour is the attitude an individual possesses towards performing the behaviour in question. Azjen’s (1985) Theory of Planned Behaviour (TPB) proposes that, where the individual may not have complete volitional control over his or her behaviours, behavioural intent is predicted by a combination of attitude towards behaviour, normative beliefs about that behaviour, and control beliefs about the behaviour (perceived behavioural control). This theory is able to both predict and understand the motivational influences on human behaviour and to identify target strategies for changing behaviour. According to the TPB, a horse owner’s attitudes towards horse management is a key determinant of the owner’s management behaviour, which in turn is a key determinant of the welfare of the owner’s horse.

A similar sequential human attitude–behaviour relationship described by the TPB has been shown in the pork, poultry, veal and dairy industries. There is considerable evidence in the animal agriculture industries of relationships between the attitudes and behaviour of the stockperson towards interacting and working with their animals, and subsequent animal behaviour, welfare and productivity outcomes. For example, studies in the dairy and pork industries have shown that cognitive-behavioural training, in which these key attitudes and behaviours of stockpeople are targeted, can successfully improve the attitudes and behaviour of stockpeople towards their animals, with consequent beneficial effects on animal stress, welfare and productivity.

The HAR research, development and education in the agricultural industries highlight the value in understanding the HAR and its implications on the welfare of animals in other animal use settings such as recreational, companion and zoo settings. To improve stockpeople’s beliefs about their animals and particularly their beliefs about handling and working with their animals, cognitive-behavioural training provides stockpeople with key information on their livestock including the ease with which livestock can and should be handled, their sensitivity to the range of ‘negative’ behaviours used by stockpeople (and their sensitivity to stressors in general), and the adverse effects of these negative behaviours on their fear of humans, which in turn can have negative consequences on their welfare, productivity and ease of handling. The training also provides stockpeople with information on ‘positive’ behaviours which can be used to reduce fear in their animals. In addition, explicit attention is given to the barriers to change (both attitudinal and behavioural) including conformity pressures from co-workers, and incorrect beliefs about perceived barriers to change, such as poor facilities, poor animal temperament and lack of time.

To address the behavioural aspects of the intervention, stockpeople are given the opportunity to rehearse the relevant behaviours, either directly or vicariously. Furthermore, a facilitator can be
used to assess stockperson responses during training to ensure that defensiveness, misunderstandings and counter arguments can be addressed. To reinforce the information that targets improvements in both beliefs and behaviours, stockpeople are provided with on-going follow-up support in the form of written material including a booklet, posters and newsletters. Evaluations of these cognitive-behavioural interventions show that this type of approach to training is practical and effective among a wide range of stockpeople working in a variety of situations. These types of training programmes have been developed and are being employed in Australia (ProHand) and Europe (Welfare Quality) for a range of farm animal species. An important characteristic of these programmes is that they are based on scientific research and their effectiveness in improving animal welfare and productivity has been demonstrated by properly designed intervention studies. Because they use a standardised form of presentation, there is a reduced risk that the content will drift over time or that individual and possibly non-validated messages will be conveyed during the training.

Research on the HAR in recreational horse ownership provides evidence of relationships between horse owner attributes, including attitudes and behaviour and horse welfare outcomes. These findings are consistent with the considerable livestock literature and the TPB, and indicate the potential to predict a horse owner’s management behaviour from their attitude towards the behaviour in question. The proposed sequential relationships between horse owner attributes and horse welfare outcomes demonstrate the opportunity to modify the husbandry and management behaviour of horse owners by targeting their attitudes towards the behaviour (salient beliefs), and subsequently reduce the incidence of poor welfare in recreational horses. A practical recommendation for modifying horse owner attributes may be the implementation of education and training programmes targeting improvement in horse owner knowledge on effective management practices to safeguard horse health and welfare. An education strategy aimed at changing the management behaviour of horse owners is likely to require a multi-faceted approach. One potential strategy would involve a two-tiered approach, incorporating both the provision of educational material and advice to horse owners, and a targeted training programme based on the cognitive-behavioural intervention programmes successfully employed in the agricultural industries to improve key attributes of stockpeople and reduce animal welfare concerns. Clearly further research is required to not only demonstrate the sequential nature of the human–horse relationship and provide evidence of causal relationships, but to determine the effectiveness of education and training programmes in improving horse owner management and subsequently safeguarding the welfare of horses.

Lay person message: The welfare of recreational horses has become an increasingly important issue, as evident by their high representation in welfare investigations. A substantial proportion of horse welfare problems are reportedly due to horse owner mismanagement, as a result of ignorance rather than intentional abuse. Based on research on the human–animal relationship in recreational horse ownership and extensive research in the livestock industries, education and training programmes which target the key attitudes and behaviour of horse owners could potentially improve the attitudes and behaviour of horse owners towards their horses and horse management, with consequent beneficial effects on horse welfare.

**Keywords:** Horse; Owner; Attitude; Management; Behaviour change; Education and training; Welfare
INTRODUCING HUMAN BEHAVIOUR CHANGE FOR ANIMALS: A NEW APPROACH TO SUSTAINABLE CHANGE FOR HORSES

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The root cause of most welfare issues for horses is human behaviour – people doing, or not doing, certain care, management or training practices. Therefore, to make a sustainable difference to equine welfare, established evidence-based models and interventions to drive human behaviour change must be looked at. Academics are active in researching welfare and related topics (e.g. assessing stress responses). People involved in equestrianism, whether leisure owners or high-level competitors, generally have a great affinity with and passion for horses. However, there is a gap between advancing scientific knowledge about equine welfare and the practical application of these findings by the people who own, train and care for horses. Around the world horses are suffering compromised welfare across the different parts of equestrian society – from horses owned for recreation, showing, breeding, to competition. Recent research has identified four main welfare challenges for horses in the UK: unresolved stress/pain, inappropriate nutrition, inappropriate stabling/turnout and delayed death. This is especially the case if welfare is defined using the Domain Model, which considers good welfare to involve an animal thriving, not just surviving; an animal having ‘a life worth living’. The health, environment and development sectors, as well as several academics working within the livestock sector, have embraced the science of human behaviour change. However, the equitation sector is turning its attention to human behaviour as the root cause of the majority of welfare issues. The Behaviour Change Wheel and COM-B Model are evidence-based tools created by UCL that can help the user understand, select and specify the target behaviour, including what needs to change; the tools themselves help to identify and develop intervention functions and strategies, together with implementation options and behaviour change techniques. The application of the evidence-based Behaviour Change Wheel and COM-B Model in the equestrian sector could help to address the gap between the knowledge available from academia and the people who own and care for horses; helping to build capacity, opportunity and motivation to deliver positive change. A strategic approach to needs is essential to bridge the gap between knowledge and application within the equestrian community. Some examples of models will be reviewed through case studies where they have started to be applied; and how they could be used to promote Equitation Science will be explained. This can only be achieved if all three themes of the conference – collaboration, communication and change are invoked.

Lay person message: The root cause of most welfare issues for horses is human behaviour, and to make a sustainable difference to horse welfare horse owners must apply the findings of research into human behaviour change. For example, the Behaviour Change Wheel and COM-B Model aid the user to identify the target behaviour and possible interventions and techniques. The application of the Behaviour Change Wheel and COM-B Model could help to address the gap between the knowledge available from academia and the people who own and care for horses. Collaboration, communication and change will be key to sustainable change for horses.

Keywords: Behaviour change; Human; Animal; Horse; Welfare; Collaboration
The welfare of show horses is a major concern globally. Management of show horses dedicated to competition frequently limits natural behaviours and need provision. Housing that restricts social interactions and limits opportunity for grazing, and implementation of certain training practices are just a few of the choices people make that may compromise the welfare of show horses with justification that the horse must be removed from unnecessary risk/injury, or trained in a particular way, to achieve the desired goals. To advance the improvement of show horse welfare globally, an understanding of human psychological characteristics underlying behaviours that impact owner decision-making must be established and evaluated. In this study, the Locus of Control theory identified by Julian Rotter (1966) was employed. Rotter posits that an individual can either have an internal or external locus of control, which has an impact on their interactions with the world around them. Those who possess traits of an internal locus believe that their abilities, efforts and actions determine the outcome of their future while those who possess traits of an external locus believe that luck, chance or other outside forces dictate their future. The aim of this study was to explore potential relationships between individuals’ perceptions of locus of control and show horse welfare as a potential variable contributing to opinions regarding overall show horse welfare in America. A digital survey from 950 respondents regarding welfare beliefs seen by the individual and locus of control was analysed. These participants represent individuals from different disciplines and volunteered to participate in this study via anonymous Qualtrics survey distribution methods. Cronbach’s Alpha for the 24 locus of control and 111 welfare items, selected for the scope of this study, were 0.845 and 0.775 respectively. Multiple regression analysis was used to test for significance between locus of control and individuals’ perceptions of show horse welfare. Two predictors which explained 2.9% of the variance (R²=0.029, F2,941=13.870, P<0.0001) were identified. Internal loci of control directed towards the individual’s ability to lead (Beta=0.034, P<0.0001) and goal achievement through hard work (Beta=0.036, P<0.01) significantly predicted perceptions of show horse welfare. The two identified variables represent factors that relate to an individual’s perceived control of a situation, in regards to working with show horses. The results support the hypothesis that individual tendencies towards an internal or external locus of control has an effect on aspects of horse management, care and training that may have an effect on how individuals contribute to a horse’s overall welfare.

Lay person message: Show horse health and wellness is critical for the improvement of horse-related industry and business. To improve welfare globally, behaviours that impact owner decision-making must be identified and discussed. If variables associated with lower welfare statuses are not identified and discussed, improper training and housing practices will continue undisputed. A survey of 950 horse people found that people’s score on ability to lead and achieve goals through hard work is related to how they perceive performance horse
welfare. Understanding how people judge horse welfare is important when trying to make changes.

**Keywords:** Show horse; Locus of control; Perception; Training; Management; Welfare
Horse owners and carers are responsible for judging the health and welfare status of animals in their care, deciding if and when professional advice should be sought and following recommendations for treatment. Research has shown that owners tend to overestimate horse well-being, and given trends towards first-generation horse ownership, it would be naive to assume that all horse owners have sufficient knowledge of health and welfare. Even where horse ownership has been a family affair and there is a wealth of intergenerational knowledge, traditional practices are often resilient to change. Understanding how owners and carers determine the well-being of their horses is necessary to identifying (1) barriers and enablers to human behaviour change for horse welfare, (2) priority areas for education, training and targeted intervention, and (3) communication strategies to engage horse owners. To understand how Australian horse owners and carers determine the health and welfare of their horses, two questions were included in a national online survey completed by a convenience sample of 505 Australian horse owners in 2012 and 2013. Descriptive analysis of data from a five-point Likert scale determined that half of the participants strongly agreed that their horse had its social and behavioural needs met completely (56%). An open-ended question elicited data about how strongly owners believed that their horse’s social and behavioural needs are met. Qualitative data analysis of free-text identified the top three responses as: the provision of unmediated company with another horse (59%), living in a paddock (36%) and having mediated contact with another horse (24%). One hundred and twenty-six participants responded to the second part of the question ‘where do you think you could make improvements?’ Their top three areas for improvement included: providing company/more company (46%), spending more time in a paddock situation (15%) or more/improved training (11%). In many cases, these opportunities were not provided because of the perceived risk of physical harm from other horses. Thematic data analysis of the unlimited character free-text responses provided deeper insight into what horse owners considered valuable to horse well-being, including: competitions and outings; training and work; interaction with humans and experiences that would occur ‘in nature’. As these findings were unprompted, it would be disingenuous to present them quantitatively or infer spread or associations. However, they do provide the basis for a theoretical discussion of the politics of ‘nature’ and anthropomorphism. In some instances, interpreting horses as being ‘like’ humans motivated horse keeping practices largely considered positive (such as providing conspecific companionship). However, there were instances where interpreting horses as being ‘like’ humans motivated practices considered negative or stressful (such as training and outings). These findings suggest that the relationship between anthropomorphism and equine welfare is far from straightforward and not necessarily negative. To accommodate these apparent mismatches, and direct them into positive horse keeping practices, there may be benefits in developing an education and communications framework based around human–horse similarity and difference as part of the public communication of Equitation Science.

Lay person message: Horse owners decide if their horse is happy or healthy. Just over half of 505 horse owners in an Australian online survey strongly agreed their horse had its social and behavioural needs met. Many participants cited reasons that were consistent with current
understanding of horse welfare, despite their justifications being examples of anthropomorphism. Findings suggest that horse welfare could be improved by helping horse owners to determine the ways in which horses are, and are not, ‘like’ humans.

**Keywords:** Survey; Owner; Perception; Behaviour change; Anthropomorphism; Welfare
A prevalent, traditional approach to horse training is based on the belief that human dominance over horses is required to gain respect and become their leader. Force and punishment may be used to achieve compliance but risk fearful reactions and defensive behaviours that interfere with learning and jeopardise horse welfare and human safety. This approach is based on the notion that horses’ social strategies can be applied to human–horse interactions. However, there is no evidence that horses perceive humans as part of their social system. Recent studies investigating leadership in horses have shown that leadership, in contrast to the traditional doctrine, is not unique to the highest ranked or oldest horse of the group but that any horse can act as leader (i.e. initiator of group movement). Moreover, the beguiling but simplistic dominance construct denies the complex social organisation of horses and the numerous factors determining social status (for example age and duration of group membership), including its context-specificity. Hierarchies often manifest during competition for resources (such as food and mates) which are usually absent in training. The relevance of dominance theory applied at the human–horse interface is therefore likely to be low. Instead, horses’ responses to training can be explained as a result of consistent reinforcement of correct responses rather than a result of humans attaining high social status and leadership roles. A recent review of nearly 100 scientific publications revealed that dominance and leadership concepts do not merit incorporation into human–horse dyads. This is supported by recent empirical data on four groups of Icelandic horses and Standardbreds (5 horses/group) that were studied during different test situations on summer pasture (i.e. novel object, novel surface, competition for food) to determine if initiators of movement were related to social status (assessed via social interactions on pasture), and whether the same initiators emerged consistently across test contexts. Horses were put in a 15 x 13m holding pen from which they could voluntarily leave to explore four objects (umbrella, pool noodles, doll, blanket), traverse four surfaces (plastic tarpaulin [PT] folded; PT unfolded; PT with traffic cones; PT with taped crosses) and feed during four repetitions of a limited resource test. Preliminary data revealed that highest-ranked horses initiated movement in only 6% of 48 tests. This was also reflected in the latency (seconds) to leave the pen which did not differ between the highest (Mean 330±134 SE) and all lower-ranked horses (258±89; W=36, P=0.845). Social status did not predict movement initiation, nor was movement initiation consistent across test contexts. An understanding of horses’ behaviour is more reliable in safeguarding their welfare during training than the attempt to translate constructs such as dominance and leadership into human–horse interactions.

Lay person message: Test results showed that high-ranking horses do not initiate group movement when faced with novelty situations and/or situations involving access to feed. This finding agrees with those of earlier studies that raised doubt about the value of using leadership and dominance concepts in horse training. Instead, knowledge of horses’ natural behaviour and learning capacities are more reliable in explaining training outcomes and therefore in safeguarding horse welfare and human safety.

Keywords: Equine; Human; Behaviour; Dominance; Leader; Training
Ongoing research in Equitation Science is increasingly valued worldwide in advancing our understanding of the equestrian partnership, particularly for influencing our changing ways of communicating, connecting and collaborating with horses. However in the practice of teaching various forms of equestrianism, including Equitation Science, there is limited research that examines the complex teaching and learning (pedagogical) interactions that can occur amongst the coach, student and horse. Results from a (qualitative) thematic analysis of 26 coaching observations and 8 coach interviews, as part of a mixed-methods study, suggest that some, albeit not all, aspects of pedagogy in equestrian sports are different to those of other sports. Three major emergent themes of difference are that: teaching and learning both equestrian and equine safety is considered essential in equestrian sports; horses do impact on how decision-making is perceived in equestrian sports pedagogy; and that adaptive equestrian coaches respond to the horse’s behaviour in addition to that of the student. Identifying these differences confirms that the horse does contribute to how equestrian coaches teach, which leads to relationally position equestrian sports pedagogy as a unique and specialist variant of sports pedagogy. Additionally, the research identifies the corresponding need for equestrian coaches to acquire specialist knowledge of how people and horses connect, communicate and collaborate. Thus, the differing concept of equestrian sports pedagogy plays an important role in developing unique coach education resources for teaching equestrian sports. Methodologically speaking, the research indicates the validity of including the (potentially complexity-inducing) pedagogical role of the coach in future student and horse (equestrian) research. The research also indicates the need for developing pedagogical theories that can be modified to incorporate the unique and special variations of pedagogy that arise in teaching equestrian sports. Hence, this presentation seeks to invoke your thoughts on, first, identifying the existence and strengths of current and potential connections between Equitation Science and equestrian sports pedagogy, and second, the importance of these connections in guiding future equitation and equestrian research.

**Keywords:** Coaching; Relational; Pedagogy; Equestrianism; Education; Collaboration
Hoof wall separation disease (HWSD) is an autosomal recessive, genetic disease currently only reported in Connemara ponies. The SERPINB11 mutation manifests as dehiscence between layers within the dorsal hoof wall, resulting in splitting and peeling of the wall. An affected pony suffers from untreatable lameness. Many affected ponies have been euthanised on welfare grounds. The genetic research to discover the cause of this hoof condition commenced in November 2011. Confirmation of a genetic link occurred in January 2012. In August 2014 the UC Davis Veterinary Genetics Laboratory released the genetic test for HWSD. While this research is not the focus of this presentation, awareness of the research process is crucial to understanding the interface between this research and the use of social media. The HWSD test is the direct result of ‘Citizen Science’ in action. Connemara breeders across several nations connected through social media, having noted correlations within certain pony bloodlines to a specific type of hoof defect. These individuals formed an active online group; the Connemara Pony Research Group (CPRG). Pedigree mapping by private individuals of this group formulated the hypothesis of a genetic cause for HWSD. The launch in November 2011 of a HWSD blog page reaching a worldwide audience (n=159,255 lifetime blog ‘hits’ to date) and the subsequent Facebook group, generated concern about this previously un-researched problem. Facebook enabled a growing number of owners to share their experiences of managing HWSD and their losses of ponies; this catalyst of international momentum forced the interface between research and social media. Google was the leading source of blog referrals (n=19,965) with Facebook second (n=17,378). A crowd-funding appeal with money being lodged with UC Davis initiated the genetic research, the aim of which was to achieve a HWSD test. Further crowd-funding via GoFundMe made it possible for one of the lead researchers to travel to Ireland to address a meeting of international Connemara pony breeders. When the research was commenced, acceptance of HWSD as an increasing issue in the breed was virtually non-existent within the ruling bodies of the breed, breeders, owners, the veterinary profession and farriers worldwide. This situation is changing through continued effective use of social media. Crowd-source funding and the use of social media to raise funds and awareness for specific research purposes is one which stakeholders within the discipline of Equitation Science could consider in the future.

Lay person message: Hoof wall separation disease (HWSD) is a genetic hoof disease. The use of social media and ‘citizen science’ is integral in generating researcher interest in HWSD. Social media was utilised to promote an appeal for crowd-funding; this raised more than sufficient money to finance the first stage of research that culminated in the development of the HWSD test. A continued, concerted social media campaign has generated international momentum resulting in increased understanding about HWSD among breeders and owners, and the making of sensible policy decisions by ruling bodies of the breed worldwide.

Keywords: Social media; Crowd-source funding; HWSD; Research; Equitation Science
Horses first arrived in Australia in 1788 and very quickly became a critical asset for farming, transport and exploration as colonisation expanded across the continent. The colonials soon needed entertainment and it did not take long for competitions involving horses to develop. The first official horse races were held in Hyde Park, Sydney, in 1810 with Bushman’s Carnival events, polo and polocrosse, jumping, ploughing and pulling competitions as well as horse breed events at agricultural shows eventually expanding into the wide range of events available today. A 2016 report by Sports Business Partners and Street Ryan for Equestrian Australia estimated the economic contribution of equestrian activities (excluding all codes of horse racing, polo, polocrosse, rodeo, Western and tent pegging) to be $1.135 billion. Horse welfare is of increasing public interest in Australia. Images of neglect, overcrowding and cruelty create strong reactions from the public, but when horses are used in competition and entertainment these responses escalate attracting far wider audiences. The virtually instantaneous availability of news and the speed of social media allow opinions and judgements often based on an image taken in 0.1 of a second to be spread around the globe extremely rapidly. It is in the best interests of any competitor to have healthy, fit, well-educated horses but competition can bring out the worst in any cohort. “Win at all costs” may be the mantra of some owners and trainers so there will always be those whose priority is the conceived value of the prize (money, fame, prestige) above horse welfare. Governing bodies are becoming challenged far more frequently to justify animal practices, particularly those perceived as ‘poor’. This increase in awareness can be a positive route for change but it can also lead to public relations nightmares and committees bogged down by inaction as they struggle to evaluate protocols and practices that were previously deemed or considered acceptable. Over the past five years a number of positive changes in horse welfare monitoring have occurred but there is more to do. Governing bodies need objective data to use as a basis for (defending and/or redeveloping) their policies and protocol; they need to be able to justify their decisions to members as well as other stakeholders in horse welfare with the least risk of misinterpretation (either deliberate or inadvertent). Collaboration with Equitation Science to inform these decisions is a great opportunity but there is responsibility on both sides to relay research results in an ethically responsible context.

Lay person message: Culturally, Australians identify with the legends of *The Man from Snowy River*, Olympic Gold in Eventing and the glamour of the Melbourne Cup, but they also want to see that horses are happy, healthy and well managed in work, competition and general horse ownership. Social media provides instant examples – good, bad and fake – of animal welfare issues. Since 2013 a number of proactive changes have been made by the governing bodies to improve horse welfare, but is there more to do? How can Equitation Science support future policies and behaviours?

Keywords: Equine; Welfare; Change; Stakeholder engagement; Collaboration; Australian horse industry
ISES was founded in part to bring research into equine behaviour and welfare, where it is related to horse training and use, across to those who ride, train and coach; with the goal of ultimately benefitting their horses. But simply making new knowledge available does not automatically lead to its application into daily practice, leaving much valuable evidence and expertise disappointingly remote from the horses it could benefit. Many researchers and practitioners in the field of Equitation Science have managed to overcome this hurdle but this year’s ISES conference is a clear recognition that we still need to do much more to both understand and then share how to translate quality research into daily usage by those who impact equine welfare the most; the riders, trainers and coaches.

Change is difficult, not just for those making a change, but also those trying to facilitate or encourage it. Like Equitation Science, Human Behaviour Change is a complex, multi-faceted and evolving field. The workshop will draw on the preceding presentations at conference to give delegates the opportunity to appreciate the complexities, as well as the potential, of using evidence-based approaches to effect changes in how people care for and train horses. If Equitation Science offers the knowledge to benefit horse welfare and the horse–rider relationship, then can evidence-based human behaviour change practices ensure it does so?

In the workshop delegates will consider global and more local, personal, challenges in their field of work and discuss and jointly develop ideas that give an appreciation of the different approaches one can take and the importance of understanding the audience and type of change desired. Delegates will also be challenged to consider change in themselves before they can be effective at bringing about change in others, whilst being inspired by their potential to drive change in their own sphere of influence by tapping into the resources available to them, especially as a result of attending the conference.

**Keywords:** Human; Behaviour; Change; Equitation Science; Equine; Welfare
POSTERS
The current research compared skull and brain morphology between horses and donkeys. Skulls of *Equus caballus*, primarily of Standardbred type (N=14) and *Equus asinus* (N=16), were obtained post-mortem. All animals had been humanely euthanised for reasons unrelated to this study. Heads were sectioned sagitally along the midline and photographed for measurement of various skull structures using Image J software. Measurements included: skull index (SI)=zygomatic width*100/skull length; cranial index (CI)=cranial width*100/cranial length; nasal index (NI)=zygomatic width*100/nasal length; cranial profile index (CPI)=rectangular area bordered by an 80mm line from orbital notch and occiput; nasal profile index (NPI)= rectangular area bordered by 80mm line from orbital notch and tip of nasal bone; olfactory lobe area (OLA); OL pitch [angle between hard palate and the OL axis]; brain pitch [angle between longitudinal axis of the cerebral hemispheres and the hard palate]; and whorl location (WL) [distance of OL from the level of the forehead whorl]. A General Linear Model determined the main effect of species with Sidak’s multiple comparisons of species’ differences among the various measurements. Donkeys had shorter heads (cranial lengths) than horses (19.7±2.5 vs 23.6±1.4cm respectively; F 1,23=51.49, P<0.0002). Donkeys also had smaller cranial widths (13±3.4cm; F 1,17=15.91, P<0.001) and mandibular depths (24±2.6cm; F 1,21=13.05, P<0.002) than horses (19±0.8 and 27.2±1.1cm, respectively). There was no species difference in SI, ZI, or NI (P>0.40), but donkeys tended to have a smaller CI than horses (F 1,17=3.59, P<0.08). Similarly, donkeys had a smaller CPI than horses (F 1,21=7.54, P<0.034), but there was no difference in NPI (F 1,21=0.05, P>0.83). Donkeys also had a smaller OLA than horses (1.4±0.3 vs 2.3±1.3cm² respectively; F 1,13=4.96, P<0.05) although there was no difference in brain pitch (F 1,23=0.69, P>0.43). The greatest difference was seen in WL, which corresponded to the level of the OL in horses, but was extremely rostral in donkeys (F 1,21=24.29, P<0.0001). These results show clear differentiation in skull morphology between horses and donkeys which may be linked to behaviour. This may be useful in validating different approaches in the training and management of horses versus donkeys.

**Lay person message:** Horses demonstrate specific behaviours which may be associated with skull shape, although nothing is known about this relationship in donkeys. This pilot study has shown that donkeys have smaller brain cases and olfactory lobes than Standardbred horses. Donkeys’ facial whorls are located lower down the face while horses’ are in close proximity to the brain’s olfactory lobe. Clarifying differences between horses and donkeys is crucial to understanding species-specific behavioural responses and providing appropriate management and training practices.

**Keywords:** Horse; Donkey; Brain; Skull; Morphology; Welfare
Transport, especially the loading phase, is known to be a stressful situation for horses and particularly for naïve horses. This usual management practice could also be a source of injuries to horses and handlers. A previous study on the effect of halogen lighting on horses loading showed that behaviours that might indicate negative emotions (i.e. head lowering, turning the head away from the ramp, sniff the ground) were shown when horses loaded from a lit area, especially when they were entering a dark trailer. Lighting is also known to play an important role in the biological and physiological mechanisms, and coloured lights were showed to have a calming effect on horses. In order to investigate the effect of LED lighting on loading and stationary phases, specific tunable-white LED luminaires were positioned on the ceiling of a two-horse facing trailer providing homogeneous lighting. Twenty-two young trotter horses (sixteen 2-year-olds and six 3-year-olds) all in the early stages of training with little experience of loading and travelling were tested in their home environment (breeding facility). Each horse was loaded in the trailer under 3 different lighting conditions (Group 1, n=11: natural lighting and 2 different white temperature from 2700 K to 6300 K): Group 2 n=11: natural lighting and 2 different light intensity), randomly assigned and with 3 weeks ± days, using negative reinforcement (from stage 1: slight pull on the rope to stage 6: second person waving arms behind the horse). Before loading, the lighting conditions were adjusted inside the trailer and full parameters including Illuminance, Luminance, Correlated Colour Temperature (CCT), Colour Rendering Index (CRI). Spectral distribution was measured for both inside and outside the trailer. Behaviours (such as locomotion, exploration, vigilance or defence), duration (sec) and heart rate (bpm) were recorded during the approach, loading and stationary phases (ramp closed) as well as resting phases in the stable before and after loading. Heart rate during resting and loading/stationary phases was then compared to determine post-stress heart rate recovery, i.e. the heart’s ability to recover after exposure to stress. Horses loaded for their first loading on a high illuminance level inside the trailer (>4500 lx) took significantly less time to approach (average time of loading : ±36 sec vs ±83 sec; Mann–Whitney, n1=n2=11, U=29,5, P<0.05) and expressed significantly less stress-related behaviours (i.e. stops, startling, vigilance) during the approach phase than those loaded in a low/moderate illuminance level (<3000 lx) (Mann–Whitney, n1=n2=11, U=30, P<0.05) for the first trial/loading. No significant heart rate difference was shown between the groups. Once loaded and kept in a stationary horse trailer under various ranges of CCT through artificial lighting, horses’ post-stress heart rate recovery was significantly faster compared to natural lighting (Wilcoxon, colour: average HR stationary ±63 vs box ±46 bpm, n1=10, z1=−2,38, P<0,05; natural: average HR stationary ±60 vs box ±51 bpm, n2=9, z2=−1,35, P>0.05). Specific LED lighting providing a homogeneous lighting with high illuminance level could reduce horses’ stress during the loading and accelerate the loading process. Similarly horses’ heart rate recovery time could be significantly reduced after stationary confinement in artificially LED-lighted trailers within certain ranges of colour
temperatures than under natural lighting conditions only. Managing light levels and type could be used to improve horse welfare during transport.

**Lay person message:** Transport and loading are recognised as stressful situations for the horse, which could be a source of injuries for both horse and humans. A high illuminance inside the horse trailer reduces loading time and the occurrence of stops, startling and vigilance behaviour during the loading phase. Specific correlated colour temperature ranges inside an artificially lighted trailer also accelerate the heart rate recovery time after a stationary confinement compared to natural lighting. LED lighting inside the trailer is therefore recommended to improve horse welfare during loading and confinement in a stationary trailer.

**Keywords:** Equine; Lighting; Illuminance; Loading; Stress; Welfare
HOW TO MINIMISE THE INCIDENCE OF TRANSPORT-RELATED BEHAVIOURAL PROBLEMS IN HORSES: A REVIEW

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This review aims to provide practical outcomes on how to minimise the incidence of transport-related problem behaviours (TRPB) in horses. TRPB are unwanted behaviours occurring during different phases of transport, most commonly, a reluctance to load, and scrambling during travelling. TRPB can result in injuries to horse and horse handler, horse trailer accidents, disruption to time schedules, inability to attend competitions, and poor performance following travel. Therefore, TRPB are recognised as a risk for both horse and horse handler. From the literature, it is apparent that TRPB are common across the whole equine industry and an initial YouTube keyword search of ‘horse trailer loading’ produced over 67,000 results, demonstrating considerable interest in this topic and the variety of solutions suggested. However, the solutions suggested by practitioners on YouTube often are not based on evidence and might be counterproductive. This review includes 73 papers related to TRPB and provides recommendations on their identification, management and prevention, highlighting pros and cons of habituation, classical and operant condition training. Since the early 1980s, TRPB have been studied and appropriate training has been advised. However, surveys reported that the incidence of TRPB has not decreased (about 40% of respondents had one or more horses exhibiting TRPB in both 1982 and 2017), horse owners still did not apply appropriate training for loading and travelling (almost half of respondents of a survey published in 2017 did not train their horses for travelling). TRPB may be also associated with injuries to both horse and horse handlers: in a recently published survey, 12% of respondents reported to have suffered an injury loading their horses, and that in 5% of those cases the horse also became injured. From the literature, it appears that in-hand pre-training, systematic training for loading and travelling, appropriate horse handling and vehicle driving skills of transporters are crucial to minimise the incidence of TRPB. In-hand pre-training based on correct application of the principles of learning for horse and horse handler, habituation to loading and travelling, and self-loading were associated with a lower risk of TRPB and are therefore strongly recommended to safeguard horse and horse handler health and welfare. This review also indicates that further research and education in transport management are essential to substantially decrease the incidence of TRPB in horses.

Lay person message: Despite TRPB having been studied for over 35 years, their incidence has not decreased. This might be related to horse handlers’ lack of appreciation of the importance of training horses for travel, or to the use of inappropriate training methods. Based on the findings of the papers analysed in this review, habituation to loading and travelling and self-loading appear to be the most appropriate training methods to reduce the incidence of TRPB and subsequent injuries to horse and horse handler. Those training methods should be implemented to safeguard horse welfare during transport.

Keywords: Horse; Injury; Problem behaviour; Training; Transportation; Welfare
EFFECTS OF USING A LIGHT-COLOURED COTTON RUG ON HORSE THERMOREGULATION AND BEHAVIOURAL INDICATORS OF STRESS

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When environmental temperatures exceed 25°C horses are potentially subject to thermal stress. It has therefore been recommended that horses should be provided with shade during hot days. However, this is not possible for horses grazing on many rural properties. Whilst the positive impact that solar radiation blocking can have on reducing heat absorption is understood by some practitioners, conflicting views, mostly anecdotal, remain on the use of a light cotton rug on horses for this purpose. The aim of this pilot study was to examine the effects of wearing a light-coloured cotton rug on horse heart rate (HR), respiratory rate (RR), rectal temperature (RT), sweat production and selected stress-related behaviours. Data were collected for two groups of university owned horses (n=8 and 10 respectively). The horses were placed in an outdoor arena and tied in direct sunlight for 2 hours. Baseline data (T0) comprising frequency of tail swishing, licking-chewing, pawing, repeated head movements and self-care were recorded using a behaviour-sampling method for 10 minutes. This was followed by recording of physiological measures and sweat production, using a sweat score (0=none to 5=excessive). Half of the horses were then rugged, and horses observed and monitored at regular intervals for 2 hours (from T15 to T120). The effect of time was not significant, therefore data were combined and analysed using the Mann–Whitney U-test with rug presence/absence as the independent variable. RT and sweat score were lower in non-rugged horses compared to rugged horses (37.4±0.3 vs 37.7±0.3 °C; 0.5±0.8 vs 1.9±1.3, respectively; U= 1865.0, U=1409.0; P<0.001). However, non-rugged horses showed a higher frequency of tail swishing (23.1±25.9 vs 8.7±11.0n/10min; U=1939.5; P<0.001). Even though wearing a rug did not have an effect on the other parameters, it is worth noting that HR, RR and the occurrence of stress-related behaviours were higher than normal, suggesting that horses were prone to discomfort. Overall, it appears that light-coloured cotton rugs may be useful to protect horses from flies as evidenced by less tail swishing, but as they do not reflect the light, rug use leads to an increase in internal temperature and subsequent sweat production, increasing the risk of thermal stress and loss of electrolytes, with a negative effect on welfare.

Lay person message: Light cotton rugs are often used to keep horses’ coats clean and to provide protection against insects and sunlight. This pilot study was conducted to determine the effects of this type of rug on physiological and behavioural welfare indicators. Overall, it appears that whilst rugging protects horses from flies, it also results in an increase in rectal temperature and sweat production. In the Australian summer, horses should not wear these rugs and instead should have access to shade in order to meet the welfare principles of good husbandry.

Keywords: Thermoregulation; Horse; Cotton rug; Stress; Welfare; Behaviour
A MULTI-NATIONAL SURVEY OF HORSE MANAGEMENT STYLES AND IDENTIFICATION OF WELFARE ISSUES AMONG HORSE ENTHUSIASTS

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Domestic feeding regimes, social isolation and barren environments can compromise horse welfare. Meanwhile, knowledge and information gathering vary greatly among horse enthusiasts. A 2012 Dutch study categorised ‘horse enthusiasts’ into four clusters based on their information gathering, emotional involvement, attitudes, knowledge and practices. The current multi-national study explored management styles, information gathering and identification of welfare issues. To establish how results from the Dutch study relate to horse enthusiasts internationally, members of the International Society for Equitation Science translated the original 42-item questionnaire into English, French, Spanish, Italian, Swedish and German before making it available through the ISES website for 12 months. This was an opportunistic sample, so the results must be interpreted with caution. The respondent numbers were: Dutch 11.3% (n=678), French 10.2% (n=615), German 1.8% (n=106), Italian 2.5% (n=152), Spanish 0.3% (n=19), Swedish 43.4% (n=2,610) and English 41.7% (n=2,510). Respondents (n=6,690) ranged from 16 to 80+ years in age (mean 37 years) and 95% were female. Most (85%) kept and cared for horses, 61% did not depend on horses for income and 70% ‘lost money’ through having horses. The most frequent sources of information were veterinarians (68%) and books (68%). The most sought-after information related to equine health (75%), training (64%) and behaviour (60%). Survey items about welfare and training methods and beliefs revealed that 69% consider negative reinforcement the most effective training method. Eighty-eight per cent agreed that, in principle, horses would rather be out of stables and 96% felt that unlimited access to forage was important for horse welfare. Frustration was selected as a cause of a stereotypic behaviour by 95% and 90% identified conspecific access as desirable. Overall, 70% of respondents stated that welfare issues occurred throughout the sector. However, beliefs about the extent of equine industry issues differed between countries ($X^2=524.31$, df=20, $P<0.01$). When asked whether government or industry should be responsible for overseeing welfare, many respondents felt that both should play a role (72% government, 80% industry). In the current study, when compared to Dutch respondents, those from other countries were more likely to prefer self-regulation to government regulation. UK respondents showed the strongest agreement with self-regulation (OR=14.5, 95% CI [11.6, 18.0]). The results of this study reveal how horse enthusiasts gather information, what type of information they seek and how they identify horse welfare. Equitation Science can provide evidence-based advice to support these areas. Differences between countries are important in addition to global issues. This study confirms the ability of ISES to provide a collaborative platform for communication between scientists and industry stakeholders.
Lay person message: Demographic differences among horse enthusiasts influence knowledge, management and information gathering. This study shows that different horse enthusiasts, recruited opportunistically through a globally distributed survey in 7 languages, gather information, what type of information they seek and how they identify horse welfare. Respondents were primarily interested in information on equine health, training and behaviour. Identification of welfare issues and responsibility for them differ between countries. Equitation Science can provide evidence-based advice on many of these topics.

Keywords: Horse; Welfare; Enthusiast; Information; Equitation; Management
Nutrition plays a critical role in equine health and welfare, and inappropriate feeding has been linked to obesity, laminitis, misbehaviour, metabolic syndrome, gastrointestinal ulceration and poor performance. In Australia, studies on nutrition and feeding have mainly focused on the horse racing industry; to the authors’ knowledge there have been no major studies investigating the management and feeding practices in other equestrian disciplines or horses kept as companion animals. The aim of this survey was to investigate current equine feeding and management practices across Australia. An online survey was designed to capture information about owner demographics, how horses are managed and what horses are being fed. The majority of survey recruitment occurred through posting on equine-related Facebook groups and pages, with additional recruitment occurring through breed societies and equine organisations including placing the survey in e-newsletters and/or websites. 4,573 responses were received, 95% of participants were female, aged 18–54. The topmost sources of information on horse nutrition were equine nutritionists (33.1%), scientific literature (29.4%) and veterinarians (24%). Only 31% of horse owners weighed their feed ration, suggesting that many owners may not be feeding the amount recorded in the survey. Recreational riding was the most common riding activity, followed by dressage, show jumping and eventing. A third of owners selected that their horses were not in any form of training, riding or work. The majority of horse owners reported their horses to have a ‘good’ body condition score. However, 15.8% of horses were recorded as ‘fat’ and 1.1% as ‘very fat’, signifying that such horses could be at risk of obesity-related diseases. Most horses were kept exclusively on pasture, yet 87.5% of all horses were fed in addition to having access to grazing. 83.34% of owners had pastures with a ground cover over 75% and 44.6% had grass above 10cm, suggesting the majority of reported pastures had adequate biomass to support grazing horses without the need for further feeding. However, a third of owners reported pastures to contain roughages typical of those made ‘horse sick’ through overgrazing, suggesting pastures are not being sustainably managed. Feed rations were analysed using the National Research Council formulas from *Nutrient Requirements of Horses*. Results show that the majority of horses are being overfed in all areas of nutrition when pasture consumption was included into the daily feed ration. Given that incorrect feeding has been linked to poor behaviour and health problems, it clearly impacts on both horse and human welfare. The results of this study recommend a collaboration of equine industry professionals to further educate owners on the role of pasture in the equine diet and that additional feeding is often not required.

**Lay person message:** An online survey collected information on what and how Australian horse owners fed and managed their horses. Data were compared to the National Research Council guidelines and the majority of horses were found to be overfed when consumption of pasture was included in the daily feed ration. Survey results suggest that horse owners often do not need to give their horses hard feed in addition to grazing pasture.

**Keywords:** Equine; Nutrition; Management; Survey; Disease; Welfare
The gap between the design of the built environment for horses and the research fields of equine science and equitation is an important area requiring examination to improve horse welfare. A new and rigorous approach has been developed that identifies, interprets and applies equine scientific findings to the way in which buildings are designed and constructed for equitation purposes, with the express intention of improving horse welfare. The application of this knowledge to the field of architecture constitutes a far-reaching and fundamental change in approach to equine housing. The prevailing forms of equine facilities are generally reminiscent of human dwellings reflecting the tendency to anthropomorphise the ‘housing’ of horses. Despite best intentions, the built environment is generally at odds with a horse’s evolved physiology and behaviour. Stables can impose limits on the horse’s ability to meet their natural behavioural needs and this can be detrimental to their welfare, by exacerbating the potential of injury, illness and negative effects on their state of mind. Natural social behaviours can be impacted upon where tactile, visual, audio and olfactory communications between individuals are restricted. Research indicates that the reduction of visual links between horses can cause undue stress, including anxiety, nervousness and restlessness and can be linked to a greater prevalence of stereotypies and physiological conditions. Inappropriate stabling can promote boredom, extended states of arousal and stress, cause overheating, airway irritation and negative repercussions from sudden changes in light. Stables can also restrict the horse’s natural kinetic behaviours such as locomotion, rolling and recumbent rest. This research discusses the key aspects of horse facility design that have a fundamental role in mitigating the negative effects of stabling, and the challenges of planning an arrangement of a ‘horses plus people’ built environment. It will elucidate the implications of equine characteristics on the effects of housing design on horse welfare. The identified features to be addressed include site-responsive design, the role of materials and construction techniques, ventilation, and planning and arrangement in reference to equine zoometrics, ethology and physiology. The success of a horse facility design to provide for the nature of these animals can be based on a set of criteria met within the planning of the building. In this way, a paradigm shift in the making of modern horse buildings is encouraged which can be applied as principles to any horse facility, because at its core is a change in perspective that stems from equine scientific research with ‘equine’ at its centre and not ‘human’. Communication between horse facility designers and equine researchers is an important link directly influencing positive change in the appropriateness of the horse’s built environment and ultimately improving horse welfare.

**Lay person message:** The practice of architecture offers great scope to improve the environments we provide for and inhabit with our horses and the impact this has on the welfare of the animals. It is in the application of objective equine scientific research to housing horses that we can direct change and develop a truly ‘best-fit’ design. An evidence-based scientific founded, equine-centric view of providing buildings that allow the horses in our care to live healthier physical lives as a result of being able to better meet their behavioural needs.

**Keywords:** horse, housing, stables, architecture, behaviour, welfare
A COMPARISON OF THE FREQUENCY OF GRAZING AND MOVEMENT BEHAVIOUR ON A TRACK PADDOCK SYSTEM COMPARED TO A CONVENTIONAL PADDOCK SYSTEM

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Track grazing systems are anecdotally suggested to promote behaviour similar to free-living horses and enable turnout without risking laminitis. However, the research that exists to quantify the impact on equine behaviour suggests limited space increases the occurrence of agonistic behaviour. The aim of the study was to quantify and compare behaviours observed in the track system with those displayed in conventional paddock turnout. Five ponies (age range 10 to 28 years, mixed breed and sex) within an established social group, accustomed to both track and conventional paddock grazing were observed. Scan sampling was conducted every two minutes for an hour (09:00, 12:00 and 15:00 each day) over five non-consecutive days during each phase, within a three-week period. Ponies were observed in three phases: on the track system (track phase); immediately after moving to the conventional paddock (unhabituated phase); and following a week in the conventional paddock (habituated phase). A total of 2,250 frequency data points were collected against occurrences of individual grazing, peer grazing, movement towards or away from peers, and movement towards or away from feeding opportunities. Significant differences in behavioural frequencies were tested using Wilcoxon Signed Rank (P<0.05). The occurrence of peer grazing appeared to be significantly higher (Z=−4.22; P<0.0001) in the track phase (57.7±18.6) compared to the habituated phase (13.6±13.6), whilst the reverse was observed for individual grazing behaviour frequency (track phase=22.0±20.0; habituated phase=65.7±14.9; Z=−4.29; P<0.001). Pony movement towards feeding opportunities (hay nets) was significantly more frequent (Z=−4.12; P=0.000) in the track phase (5.8±3.5) compared to the habituated phase (1.2±1.5). Although there were no significant differences in movement towards or away from peers, movement was overall more frequent on the track system compared to the habituated phase (Z=−4.34; P<0.001). Significant differences were also observed when findings were compared against the unhabituated phase, highlighting the importance of an acclimatisation period. The track system appeared to promote close proximity grazing more than the conventional paddock, likely due to limited foraging opportunities but also mimicking the collective behaviour of feral horses moving between foraging sites. Although further experimental work is required, these provisional findings suggest that the track system can be used in equine management practices to promote positive equine welfare by providing opportunity to consummate innately motivated grazing and foraging behaviours.

_Lay person message:_ A small study comparing behaviour on a track grazing system with conventional paddock grazing suggests that the use of a track system helps to promote good equine welfare due to the occurrence of behaviours that are observed in free-living horses and ponies. Whilst conventional paddock turnout is used to enhance equine welfare, the track system may offer an alternative way to manage pasture whilst continuing to facilitate positive experiences for the horse.

_Keywords:_ Grazing; Track; Paddock; Herd; Horse; Welfare
HORSE FATALITIES AND THEIR EFFECTS ON JOCKEYS IN RACES IN NEW SOUTH WALES AND THE AUSTRALIAN CAPITAL TERRITORY, AUSTRALIA (2009–2014)

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Monitoring racehorse fatality and associated jockey falls can provide benchmarks for intervention strategies. The objectives of this study were to describe the incidence of, and reasons for, fatality in Thoroughbred flat races in the Australian Capital Territory (ACT) and New South Wales (NSW), Australia, and to describe the reporting of jockey falls and injuries associated with racehorse fatalities. A cohort study identified all racehorse fatalities disclosed through Racing NSW’s public websites for the 2009/2010 to 2013/2014 racing seasons. The incidence of racehorse fatality, fatal musculoskeletal injury, spontaneous death (vs euthanasia), and racehorse-fatality associated jockey falls and injuries were calculated as the number of events per 1,000 starts. A total of 167 horse fatalities were disclosed, with an overall incidence of 0.59 deaths per 1,000 starts. Forty-nine reasons for horse fatality were reported, although post-mortem was conducted in only 31.5%. Musculoskeletal injury accounted for 86.2% of all fatalities, with an incidence of 0.52/1,000 starts. Fractures comprised 57.5% of fatalities, with the fetlock or proximal sesamoid bones the most common fracture location (37.5% of fractures). Only 13.3% of racehorse fatalities were due to spontaneous death, an incidence of 0.08 per 1,000 starts. A total of 50 racehorse-fatality associated jockey falls were reported (incidence of 0.18 per 1,000 starts), with 32 reported jockey injuries (incidence of 0.12 per 1,000 starts). Most racehorse fatality-associated jockey injuries occurred to the limbs (53.1%), particularly the upper limb. This study has provided evidence that horse fatality and associated jockey injury estimates in the ACT and NSW were comparable with previous estimates globally.

Lay person message: It is important to accurately describe racehorse fatalities to quantify the impact of interventions designed to improve safety and welfare. This study identified all racehorse fatalities disclosed through Racing NSW’s public websites for the 2009/2010 to 2013/2014 seasons. There were 167 horse fatalities, most commonly due to musculoskeletal injury (86.2%) and 50 racehorse-fatality associated jockey falls. This study has provided evidence that horse fatality in the ACT and NSW were comparable with previous estimates globally.

Keywords: Epidemiology; Fatality; Horse; Jockey; Racehorse; Thoroughbred
Trot pole exercises are used as a tool to improve equine performance or as a component of rehabilitation regimes. Horse and rider combinations complete a series of evenly spaced poles either on the ground or raised to encourage limb flexion, straightness and increased coordination. The increased limb flexion required is thought to activate the horse’s core musculature including rectus abdominus (RA) to retain stability. This study aimed to investigate differences in equine RA workload between trotting on a horizontal surface and completing pole work exercises. Six horses, H1–H6 (1 mare; 6 geldings), of variable age (13±4 years) and height (1.6±0.1m), confirmed sound by their owners and experienced in undertaking trot pole exercises participated in the study. Prior to data collection, an area over each horse’s RA (4cm²) was shaved (0mm) and cleaned with alcohol. Two Delsys Trigno™ standard surface electromyography (sEMG) electrodes were placed on the RA 6cm bilaterally to the umbilicus, cranial to the tuber coxae and parallel to the direction of muscle fibres. Horses were videoed being ridden 3 times through 15m for each condition after completing a warm-up: no poles (NP) followed by two trot pole exercises of 8 poles (3m length, 0.1m diameter, spaced at 1.35m), with poles on the ground (GP) and with raised poles (RP) (0.2m). Mean and maximum right and left RA contractions were normalised to the maximum dynamic contraction from condition 1 using integrated EMG. Friedman’s analyses with post-hoc Wilcoxon signed rank tests with a Bonferroni adjustment applied (revised alpha P<0.02) identified if differences in RA workload occurred between the conditions, for the cohort and individual horses. No significant differences were found for the mean (MeW) or maximal (MaW) workload for the cohort between the three conditions (P>0.05). A high degree of lateralised variability in RA activity was seen for individual horses. Significant increases in MaW occurred for four horses; H2 and H4: NP to GP (P<0.001; z=3.18, df=9), NP to RP (P<0.001; z=3.21, df=9) and GP to RP (P<0.001; z=3.18, df=9). For H5: NP to GP (P<0.05; z=2.44, df=9), NP to RP (P<0.001; z=2.94, df=9) but not between GP to RP (P>0.05). However, H6 recorded a significant decrease in workload between GP to RP (P<0.05; z=2.42, df=9) but not between NP and GP or RP (P>0.05). The results suggest trot pole exercises can increase RA activity compared to working on the flat in some horses. Understanding and communicating the effect of common exercises, such as pole work, on muscle activity can ensure they are used appropriately to improve equine welfare.

**Lay person message:** Trot pole exercises are used in the equine industry to improve a horse’s performance or as part of rehabilitation regimes. However, the specific effect of pole work on activation of the horse’s core musculature has not been investigated. The rectus abdominus is one of the horse’s core muscles and its activity was measured during pole work. Increases in RA contraction between flatwork and pole work occurred in 50% of the horses studied. Trot pole exercises increase RA activity in some horses. An increased understanding of how pole work affects muscle activity can inform their correct selection within training regimes to improve equine welfare.

**Keywords:** Electromyography; Pole; Exercise; Equine; Training; Rehabilitation
THE EFFECT OF THE PESSOA TRAINING AID ON EQUINE *RECTUS ABDOMINUS* WORKLOAD ON A TREADMILL

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Equestrian trainers use the Pessoa training aid (PTA) to improve strength in horses with muscular hypotrophy present because of underlying pathology and a lack of training. Kinematic analysis has found the training aid creates a shift in weight bearing from the forelimbs to the hindlimbs, producing spinal flexion and activation of the horse’s core musculature, including *rectus abdominus* (RA), which increases engagement of the hindquarters and generates muscle hypertrophy with repeated use. To date the impact of the PTA on RA workload has not been evaluated. The aim of this study was to investigate if differences occurred in equine RA workload with the PTA at the low and middle positions compared to no PTA. Seven horses of mixed breed, age (9.7±3.2 years) and height (162.56±8.13cm) accustomed to working in the PTA and working on a high-speed treadmill (HST) participated in the study. Horses were assessed by a veterinary physiotherapist to ensure they were fit to participate and that no muscle hypotrophy or asymmetry was present. A 4x4cm site overlying the RA of each horse was prepared (0mm skin clip; alcohol preparation) and two Delsys Trigno™ standard surface electromyography electrodes were attached 6cm lateral to the umbilicus. Reflective markers were secured to the lateral wall of the left forelimb and hindlimb hooves, T4 (the withers), the poll and the sacrum to enable assessment and matching of limb phasing during analysis. Each horse completed a 3-minute warm-up on the HST in walk then completed three trials of 3-minutes duration in walk (1.45m/s) and trot (3m/s): (1) no PTA, (2) low PTA and (3) middle PTA in a randomised order. Mean and maximum right and left RA contractions were then normalised to the maximum dynamic contraction from condition 1 for 10 matched and consecutive strides using integrated EMG. Friedman analyses with post-hoc Wilcoxon signed rank tests (Bonferroni adjustment applied: revised alpha P<0.02) identified if differences in RA workload occurred between the conditions across the cohort. No significant differences were found in RA activity between no PTA and the use of the PTA in the low or middle position, or between the low and middle position (P>0.05). The results suggest when used in the low or middle position the PTA does not increase RA workload in walk and trot on the HST. In practice PTAs are also often used during lungeing, therefore further work is required to support our findings in field environments and evaluate the broader use of the PTA within equitation. The breast bar of the HST appeared to restrict horses’ head and neck position potentially influencing the results gained, and its impact should be considered in future kinematic studies utilising a HST. The global use of training aids without understanding their specific action on the horse’s musculoskeletal system has the potential to compromise equine welfare. Therefore evidence-informed protocols outlining how to use training aids are warranted and could enhance equine welfare and performance.

Lay person message: The Pessoa training aid is used by trainers to build and strengthen the back muscles and hindquarters in young or weak horses, or within rehabilitation regimes through engaging the horse’s core muscles including *rectus abdominus* (RA). No differences in RA workload were found in 7 horses when exercising in a straight line on a treadmill wearing the PTA (in both the low and middle positions) and not wearing the Pessoa. As the Pessoa is often used in practice during lungeing, repeating assessment in the field is advised to evaluate if differences occur on a circle.

Keywords: Training; Aid; Pessoa; Equine; Rehabilitation; Performance
The reins are one of the main means of communication between rider and horse, but little objective information on rein tension exists. The study aimed at investigating the influence of equine and human laterality on rein tension in Western (W) and English (E) riding styles. Mean and standard deviation (SD) of rein tension were measured in 47 riders (14 left-handed (LH), 35 right-handed (RH), 2 ambidextrous) and 61 horses (34 right-lateral (RL), 27 left-lateral (LL), 10 without side preference (NL)) as assessed by their riders based on horses’ preferred side for riding in walk, trot, canter and gait transitions in both directions on straight lines and circles in E (50 rides) and W (43 rides), all with snaffle bits or bitless bridles. Mixed-model analysis accounting for horse, rider and horse*rider interaction as random effects (F test throughout) revealed a stronger (e.g. left rein, mean: 12.5±1.9N LL*LH and 9.8±1N LL*RH vs 9.3±1N RL*LH and 8.3±0.9N RL*RH; left rein, F_{13,410}=4.83) and less stable contact (SD:10.5±1N LL*LH and 8.1±0.9N LL*RH vs 7.4±1N RL*LH and 6.8±0.8N RL*RH, F_{13,525}=2.38, all P<0.0001) with left-laterality in both horses and riders, compared to right-lateral individuals. RH showed the most asymmetric mean rein tension in the right rein with RH*LL (9.8±1N left rein vs 10.3±1N right rein, F_{13,410}=4.83, P<0.0001). LH showed the strongest mean tension in the left rein with RL (9.3±1N left rein vs 8.7±1N right rein) and less stable but more symmetric mean rein tension with LL (12.6±1.1N left rein vs 12.8±1.1N right rein, F_{13,410}=4.83, P<0.0001). Based on variance components from the mixed-model analysis, both the rider and the horse explained with 33.2±0.0% each a significant (Likelihood Ratio Test P<0.05) proportion of the total variance in mean rein tension. However, specific horse–rider combinations did not contribute significantly to the total variance. In contrast, with SD of rein tension, the rider (14.9±5.8%, Likelihood Ratio Test P<0.05, Z=2.41) but neither the horse nor the horse–rider combination explained significant proportions of the total variance. Equine laterality and human handedness both influenced rein tension. Instability seemed to relate to the influence of the rider, whereas asymmetries were related to different directions of laterality in horse–rider combinations. Equine laterality seemed to influence the magnitude of rein tension. Since asymmetric rein tension and cues affect horses’ learning, training might be easier with matching directions of laterality in horse–rider combinations. High rein tension applied persistently to horses with a side preference might negatively affect their welfare.

Lay person message: Horse and human handedness both influenced rein tension. A horse–rider combination with the same side preference achieves more symmetric and stable rein tension than combinations where the horse and rider differ. Equine side preference seems to influence the amount of rein tension, which might be an important factor in considering equine welfare. Matching horse–rider side preference might be beneficial for training.

Keywords: Rein tension; Laterality; Handedness; Symmetry; Horse–rider; Welfare
The impact of riders and handlers on horses has come under increasing scrutiny as the technology to measure physical horse–human interaction has become more readily available. Reins are commonly used to deliver signals and instruction to horses through the application of tension and resulting pressure. To date all rein tension studies, such as those examining the influence of physical attributes of reins and their use in different gaits, have relied on two-handed rein use. Since effective rein use is crucial for the delivery of clear distinguishable signals and subsequently the discernible release of pressure when the required response is given by the horse, the aim of this study was to examine the effectiveness of rein use when held in two hands as most riding instruction dictates or when held in a single hand as required in some equestrian disciplines.

Twenty female riders (28.2±10.1 years), self-rated as experienced, representing a wide range of equestrian disciplines sat in a general purpose saddle secured on a stationary fixed saddle stand with the stirrups set at their usual riding length. Centaur Rein Tension gauges were fixed to a solid box at horse head height and fitted with a standard pair of leather 5x20mm wide reins. Participants were asked to take up the rein tension that they would use when riding in trot. This was repeated 3 times per condition (using both hands and one-handed, using the riders natural hand of choice) using a cross-over design with a 30-minute wash-out period. Rein tension data (N) were analysed using parametric paired t tests. No significant differences were evident between left- and right-hand rein tension when using two hands (t59=1.89; P>0.05; left=4.73±2.65N; right=4.91±2.63N) or one hand (t59=0.20; P>0.05; left=4.21±2.32N; right=4.17±2.91N). Comparison of left–right hand difference in rein tension for two-handed versus one-handed test conditions was also non-significant (t59=1.24; P>0.05). Although there was less absolute difference between left- and right-hand rein tension when riding with one hand than with two hands, the use of the left and right reins is less consistent with one hand than with two. Greater understanding of the direct impact of rider rein use on clarity of signals relayed and pressure release achieved is essential to safeguard horse welfare. Reliable rein tension studies that include different riding styles are required to improve understanding of the rider’s effect on the horse in order to bring about changes in practice that will improve the welfare of horses used in equestrianism.

Lay person message: The effect of riders on horses is becoming easier to investigate, for example the tension applied to horses with reins. Reins can be used in two separate hands or held in a single hand and are one of the main ways that riders give signals to the horse. There was no difference in the tensions applied with the left and right hands regardless of whether the reins were held in two independent hands or in a single hand. If rein tension studies are to be used to improve horse welfare, both two-handed and single-handed riding modes should be investigated.

**Keywords:** Rein tension; Rider; Hands; Contact; Welfare; Equestrian discipline
DEVELOPMENT OF A PROTOTYPE FOR REFEREES TO MONITOR WHIP USE IN HORSE RACING

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There is no standard surveillance system for modern flat horse racing in Sweden, so the surveillance camera placement and image quality varies between tracks. Reported whip misuse and unauthorised whipping often occur outside of the camera’s view and are therefore unrecorded. Thorough investigation of the current monitoring system used in Sweden revealed concerns about whether the stewards have enough time to estimate the number of whip strikes per horse, even when camera quality is sufficient, and has led to the development of an enhanced whip system. The system prototype offers a technical solution for the supervision of whip use in modern horse racing, and it would be useful in countries where there are regulations limiting the number of strikes. Current specifications allow the system to record the attributes and number of strikes and to relay the data contemporaneously to the stewards. The system does not interfere with the operation of the camera monitoring system. Since the number of strikes is reported with total accuracy, stewards are afforded more time to focus on matters of interference and actions that are important to the final result list. The prototype is a whip with a custom-made force sensor placed on both sides of the cushion pad. The sensors measure an area 24mm wide by 275mm long and cover the entire padded part of the approved race whip. The sensor is constructed of polyester that is 0.203mm thick. The force sensor is connected to a microcontroller mounted in the handle of the whip. The microcontroller processes the sensor data and sends the information via radio waves up to 1.7km in outdoor conditions to a second microcontroller located in the steward’s office. The whip strike sensor prototype is able to distinguish between a wave of the arm that leads to no impact and a strike. The software allows the force of each strike impact to be recorded. The intention is to embed the whip strike sensor within the body of whips used in a range of equestrian disciplines in which whip use is permitted. The possibility to register the properties of whip strikes will help to safeguard the welfare of horses used in these disciplines and provide information to the equestrian community that could change the way whips are used in training and racing.

Lay person message: The whipping of horses in racing leads to concerns about animal welfare globally. A whip strike sensor prototype has been developed that will facilitate detailed exploration of the effect whips have on horses and allow stewards to accurately assess the number of strikes made and forces used. It is intended to integrate strike sensors into whips used in disciplines where whipping is allowed; this will help to safeguard the welfare of horses used in these disciplines.

Keywords: Horse racing; Technology; Whip; Force; Sensor; Welfare
DEVELOPMENT OF A SYSTEM FOR COLLECTION OF POSITIONAL-BASED DATA FOR HORSES

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Data gathering is a crucial part in many Equitation Science related projects, and this can be a very resource-intensive and time-consuming process. This project aimed to develop a tool to aid Equitation Science researchers in gathering positional-based data of horses. A prototype data collection system was developed, designed to enable cost-effective data acquisition, storage and presentation. The prototype system includes a GPS-enabled collar for collection of positional data, as well as a platform for presenting the gathered data online. Interviews were conducted with Equitation Science researchers in order to determine the requirements of such a system and to ensure that data obtained would be of sufficient quality. The GPS collar developed incorporates a microcontroller which allows tracking of horses within one metre. Furthermore, it is possible to extend the capabilities of the device using appropriate hardware to gather different types of equine data. The data gathered by the GPS collar are uploaded to a server where data are stored in a relational database ready for access by the scientist via a graphical user interface using a dedicated website. The user interface was developed using commonly practised interaction design methods such as user studies, heuristic evaluation and cognitive walkthroughs to ensure a user-friendly experience. Equitation Science experts contributed to both the design of the systems software in addition to the design and placement of the collar. It is anticipated that the GPS collar system can be used in Equitation Science projects that require identification of movement patterns of both individual horses as well as groups of horses, and will be able to provide measures such as distance moved and speed of movement. The system is designed to be future proof and able to be easily adapted according to the requirements of specific studies. For the Equitation Scientist in practice, the system provides the possibility to collect objective data from horses’ activities by removing the effect of the potentially biased human observer, and might thereby improve the quality of the conclusions in the scientific study.

Lay person message: An electronic system has been developed to simplify the collection of positional-based data for equine research. The system consists of a GPS collar which collects data from horses and associated software accessed through a website for analysing and presenting the data. The system can be used in many different types of horse-based projects and will allow more objective data to be collected that can be used to understand horses and to improve horse welfare by removing the effect of the potentially biased human observer.

Keywords: Equine; Data recording; Positioning; GPS; Software; Welfare
Horses spend 4 to 15 hours/day in standing-rest. Deviations from normal resting behaviour can indicate a multitude of problems including negative affective states (e.g. anxiety), physical problems (e.g. lameness), housing issues (e.g. inappropriate substrates) or social problems (e.g. aggression between group-housed individuals). Monitoring resting behaviour requires time-consuming live or video observation; therefore, automating measurement would be helpful for the early identification of welfare problems. Accelerometers have been validated for identifying standing and lying in cattle, goats and horses; however, validation to determine whether a horse is standing square (i.e. all four legs bearing weight) or in standing-rest position (i.e. one hind leg rested and not bearing equal weight) is lacking. This was a proof-of-concept case study investigating if a tri-axial accelerometer could be used to monitor the standing-rest position in horses. A subject horse (12-year-old, Thoroughbred x Clydesdale gelding) was cross-tied in his stall. Accelerometers (HOBO® Pendant G Data Logger) were positioned on the outside of both the right and left hind leg, vertical to the floor, at about 10cm above the fetlock (metatarsophalangeal joint) and held in place with cloth polo wraps. Accelerometers were set to record g-force values for the x-axis (pointing upwards) and z-axis (pointing inwards toward the animal’s leg) at 1-second intervals. Both hind legs were continuously filmed for 2 hours. Left and right hind leg positions were then scored as standing square, standing-rest or shuffling (leg in motion) for each second of recorded video and for comparison to the accelerometer data. Data were analysed in R using a classification Random Forest model with left and right leg raw g-forces. Seventy-five per cent of the data were used as training for the model and 25% for testing. Overall accuracy for the model was 95% when both x- and z-axes for left and right legs were included and 92% when only the x-axis was utilised. Sensitivity and specificity were calculated using just the x-axis and were good for left leg standing-rest (91.6%, 94.8%), right leg standing-rest (91.4%, 98.3%) and standing square (94.3%, 88.2%), but poor for identifying shuffling (0%, 99.9%). This high level of accuracy for correctly determining when the horse was in a standing-rest position provides the first supporting evidence that an accelerometer using a single axis can reliably measure this aspect of resting behaviour in horses. Follow-up work using multiple horses is continuing the validation process for such use of these accelerometers.

Lay person message: Horses spend 4 to 15 hours/day in a standing-rest position; therefore changes in this behaviour may be indicative of compromised welfare. Accelerometers have been validated for measuring rest behaviour in other species but not for standing-rest in horses. This was a proof-of-concept case study, where recorded video of a horse’s resting behaviour was successfully matched to data recorded by accelerometers attached to each hind leg. Accelerometers show promise for the automated monitoring of standing-rest in horses.

Keywords: Equine; Behaviour; Monitoring; Accelerometers; Rest; Welfare
Whilst the benefits to humans of equine-assisted activities (EAA) have been well researched, the welfare of horses used in EAA has not received as much attention. The horse’s prescribed role as a psychotherapist in EAA may subject it to physical and emotional emanations of the human patient. This study hypothesised that horses exposed to humans with PTSD would display more signs of behavioural and physiological stress than with ‘neurotypical’ humans. Seventeen therapy horses (5 mares, 12 geldings (16.4±3.6 years) of various breeds) were individually subjected in a 13m-diameter round pen to each of four treatment humans clinically diagnosed with Post Traumatic Stress Disorder (PTSD) and four neurotypical humans who were matched physically to the PTSD humans. Both horses and humans were equipped with a heart rate (HR) monitor recording HR (bpm) every 5 seconds. Salivary samples were collected from each horse 30 minutes before and after each trial to analyse cortisol concentrations. Each trial consisted of 5 minutes of baseline observation of the horse alone, after which the PTSD human entered the pen for 2 minutes, followed by an additional 5 minutes of the horse alone. A professional acting coach instructed the neurotypical humans in emulating the physical movements of their paired PTSD subject, after which the neurotypical human was tested. Behavioural observations indicative of stress in the horse (gait, head height, ear position, body position and distance from the human, latency of approach to the human, vocalisations and chewing) were retrospectively derived from video recordings and analysed using a repeated measures GLM. Sidak’s multiple comparisons analysed differences between treatments and time periods. Horse behaviours ($F_{1,21864}=2.63, P>0.1$) and salivary cortisol ($F_{1,213}=1.37, P>0.24$) did not differ between PTSD and neurotypical humans. In general, horses moved slower ($F_{2,21864}=88.94, P<0.0001$), carried their head lower ($F_{2,21712}=140.53, P<0.0001$), vocalised less ($F_{2,359}=30.03, P<0.0001$), chewed less ($F_{2,362}=12.67, P<0.0001$) and exhibited lower HR ($F_{2,21467}=94.86, P<0.0001$) when any human was present in the round pen. Since two of the PTSD/neurotypical human pairs were experienced with horses and two were not, a post-hoc analysis showed that horses approached quicker ($F_{1,54}=6.2, P<0.001$), stood closer ($F_{1,376}=9.14, P<0.01$), and oriented their ears ($F_{1,370}=13.07, P<0.0003$) more toward humans who were experienced with horses. Horse HR was lower when paired with inexperienced humans ($F_{1,2153}=16.9, P<0.0001$) whereas inexperienced human HR was higher than experienced humans’ HR ($F_{1,375}=704.25, P<0.01$). Overall, behavioural and physiological responses of horses to humans is more pronounced based on human experience with horses than whether the human is diagnosed with PTSD or not.

**Lay person message:** In equine-assisted activities horses are often credited with intuiting human needs, however horses do not appear to respond differently to humans with PTSD than to those without. Horses did appear more attentive to humans with more horse experience. Any behaviours the horse portrays are based on the human as an individual rather than any condition the human may suffer from. Understanding the horse’s response can lead to improved welfare and horse and human safety.

**Keywords:** Equine-assisted activities; PTSD; Behaviour; Cortisol; Heart rate; Welfare
FACTORS INFLUENCING THE SYMMETRY AND MAGNITUDE OF REIN TENSION IN ENGLISH AND WESTERN RIDING

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The reins are one of the main means of communication between rider and horse, but little objective information on rein tension exists. The aim of this study was to investigate factors influencing the symmetry and magnitude of rein tension in Western (W) and English (E) riding. Rein tension was measured in a total of 93 combinations of 49 riders and 71 horses in different gaits and standardised tasks in E (50 rides) and W (43 rides), all with snaffle bits or bitless bridles. Mixed-model analysis was used (F test throughout). The magnitude of mean tension varied between and within the different gaits and transitions (walk: 6.7±0.7N, rising trot: 8.4±0.7N, sitting trot: 10.1±0.7N, canter: 12.4±0.7N, different gait transitions: 8.7±0.8-14.6±2.2N, F 11,2841=81.84, P<0.0001). English riders applied overall higher rein tension (E: 13.1±2.3N vs W: 5.7±2.4N, F6,150=10.58, P<0.0001) and tensions differed within the specific disciplines, too (show jumping: 19.7±4.3N, dressage: 12.5±1.4N, leisure riders: 11.2±1.3N in E, reining: 6.5±1.3N, cutting: 5.3±1.3N, all-round: 4.9±1.2N in W, F6,137=10.86, P<0.0001). Riders performing additional sports applied higher rein tension (10.3±0.8N vs 9.3±0.7N, F1,2342=7.43, p=0.006). Riders assessing their own contact as “very strong” had indeed significantly higher mean tension (21.8±5.5N) compared to strong (9.9±0.8N) or light (9.2±0.8N) contact (F 3,161=8.59, P<0.0001). Performances perceived as symmetric showed higher tension (10.5±0.7N vs 9.2±0.7N (asymmetric), F1,1962=8.55, P=0.004). Those described as “very harmonious”, showed the highest rein tension (12.3±1.2N), whereas lightest contact was applied to horses perceived as tensed (harmonious: 12±0.9N, unharmonious: 11.5±0.9N, tensed: 7.1±1.2N, F4,210=8.71, P<0.0001). Riders applied more tension to the inside than the outside rein, regardless of the direction (P=0.04). Asymmetry was stronger on a circle (e.g. counter-clockwise, circle: 10.2±2N inside rein vs 8.5±2N outside rein and counter-clockwise, straight: 9.7±2N inside rein vs 9.2±2N outside rein, F7,1168=2.07, P=0.04). However, only rides with reported problems to bend clockwise showed asymmetric rein tension overall (8.7±0.8N left rein vs 9.3±0.8N right rein clockwise, 12.4±0.8N left rein vs 12.3±0.8N right rein counter-clockwise, F6,1789=11.64, P<0.0001). Rein tension of American Quarter Horses was lower and more symmetric (4.9/4.8±0.7N) in W, compared to warmbloods (9.6/10.1±2.1N) and other mixed breeds (8.8/8.6±0.8N, F3,3437=3, P=0.03) in either W or E (F2,73=8.6, P=0.0004). Factors such as bridle, gender, lateral displacement of the hindquarters, direction of mane, forelimb preference, riders’ assessment of contact stability and former injuries in horses and riders did not influence rein tension or relate to laterality (all P>0.05). The magnitude of rein tension is related to or influenced by gait, speed, sitting vs rising trot, riding style, disciplines, riders’ experience and additional sport activity. Left–right rein symmetry appears to be related to equine laterality and influenced by horse breed. Importantly, the rider’s perception of rein tension is inaccurate, which is likely to affect training as riders may inadvertently maintain too strong contact and/or give rein aids of inappropriate intensity. Consequently, horse welfare can be affected either through painful bit pressure or through inappropriate punishment of the horse for misunderstanding the rider’s inappropriate cues. Using objective methods to quantify rein tension in daily training might assist riders in better judging their own quality of rein contact.
Lay person message: The amount of rein tension applied by riders appears to be influenced by gait, speed, rider posture, riding style, discipline and sport activity. Rein tension did not differ between snaffle bits and bitless bridles. Symmetry is related to the laterality of horse–rider combinations and varies with horse breeds. The rider’s perception of rein tension is inaccurate which might affect training and horse welfare.

Keywords: Rein tension; Symmetry; Laterality; English; Western; Riding
IN SEARCH OF THE ORIGIN AND DEFINITION OF THE TERM ‘KREUZ’ RESP. ‘KREUZANSPANNEN’ ('BACK' RESP. 'BRACING THE BACK') IN EQUESTRIAN PARLANCE: A REVIEW

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The complexity of riding is further complicated by the complexity of language. The terms ‘Kreuz’ resp. ‘Kreuzanspannen’ ('back' resp. 'bracing the back') are used frequently but lack clear definition and are therefore incomprehensible for many horse people. The aim of the present study was to trace their origin, spread and apparent errors in translation as well as to suggest a definition. For this purpose, an in-depth literature search in German, English and French equestrian literature for the terms ‘Kreuz’/‘Kreuzanspannen’ and related anatomical and biomechanical aspects was conducted. Sources included university libraries and private archives of academic and practitioner colleagues. Overall, the search yielded 109 printed documents (n=5 English, 4 French, 87 German, 12 French/German, 1 Italian/German) and 75 online resources (n=5 English, 4 French, 66 German). Among the literature investigated, two alternatives of the earliest documented use of the term ‘back’ or its equivalents in other languages emerged: (a) according to Stricker (1992) François Antoine de Garsault (1741) was the first to use the term ‘back’. (b) Gräfe (1861) credits Salomon de la Broue (1741) was the first to use the term ‘back’. Gräfe refers to a later German translation of the 18th century that might have first introduced the term or to the original French version (which unfortunately were unavailable for the present literature review). The search was further complicated by an abundance of translation errors. For example, in the German translation of Du Paty’s (1826) treatise coccyx and pubis have been interchanged, which likely led to great confusion in riders trying to follow this text. It remains unclear how many other translation errors remain unnoticed, especially if less obvious and only concerned with nuances of anatomical differences. Notably, the German Equestrian Federation replaced the term with ‘Gewichtshilfen’ ('weight aids') starting from the 2012 editions of their riding theories, although it is unclear whether this term leads to improved understanding. Based on the most plausible explanations in the investigated literature, the term ‘Kreuz’ originates from the French word for kidneys and, essentially refers to the lumbar region of the back which plays a key role in facilitating the rider’s stability and suppleness. ‘Kreuzanspannen’ refers to the action of tilting the pelvis, such that the pubis is moved forward–upwards and the structures of the ‘Kreuz’ are tensed, with the purpose of cueing the horse. Ultimately, creation of an international glossary would be desirable, facilitating faster and easier communication, especially for the beginner rider. Such clearly defined terms should be used as a counterpoint to the omnipresent but nebulous explanation ‘that must be felt’.

Lay person message: Traditional equestrian language, such as the expression ‘brace your back’, might lead to confusion in riders due to anatomical inaccuracies of these terms. A literature search was conducted to trace the expression’s occurrence and its original meaning. Due to translation errors, lack of linguistic accuracy as well as riding masters’ lack of detailed anatomical knowledge, the meaning of the term ‘back’ has changed considerably over the centuries. Creating unambiguous, anatomically correct definitions would avoid confusion thereby improving riders’ training success and horse welfare.

Keywords: Back; Bracing; Language; History; Equestrian literature; Communication
The aim of the present study was to assess practitioners’ understanding of the term ‘Kreuz’ resp. ‘Kreuzanspannen’ ('back' resp. 'bracing the back'), as these terms are commonly used by riding instructors, but may lead to confusion in riders due to a lack of anatomical precision as well as a lack of otherwise useful descriptions in the equestrian literature. For example, it is not clear exactly which part of the back is being referred to. Continued tensing of the back would lead to undesired stiffness in the rider. An online questionnaire with 25 questions assessing participants’ definition of the terms and anatomical relationships was distributed via Austrian and German equestrian magazines, social media and various personal contacts. There were 597 respondents (266 fully completed) of which 319 were dressage riders. Only the data from the 319 dressage riders are reported. They included 35 professional riders (PR) of all skill levels up to Grand Prix as well as amateur riders participating (A, n=144) or not participating in competitions (AC, n=140). Chi-square tests were used to assess differences in proportion of correct responses between PR, A and AC. Responses revealed that practitioners’ definitions of the two terms varied widely and, for example, posture and cues were frequently confused (e.g. with the question of whether back muscles were used during the action of ‘Kreuzanspannen’), 8 of 12 PR referred to the seat (=posture), 2 stated they did not know it and 2 referred to the equivalent question on the term ‘Kreuz’. Professional riders did not necessarily have a better knowledge on the subject and did not give more anatomically correct definitions, compared to A and AC (proportion of correct responses, Chi²: P<0.05). Even though all professional riders were familiar with the term, all parts of the body (i.e. back, stomach, pelvis, legs, shoulders and head) except for the arms were included in their responses, and two respondents did not know which body part to refer to. Of the A riders, 110 of 142 were able to correctly identify the anatomical areas for ‘Kreuz’ (back, abdomen, pelvis) and, at the same time, assign the corresponding muscles (i.e. pelvic floor muscles, lumbar multifidus, interspinales, intertransversarii, psoas, etc.). The corresponding data for AC riders were: 100 out of 140 and 73 respectively. In conclusion, until now general uncertainty about the term ‘Kreuz’ or ‘Kreuzanspannen’ prevails. Besides gaining theoretical knowledge, anatomically correct definitions of the terms would improve riders’ understanding of trainers’ instructions, thereby improving training success as well as equine welfare due to reduced miscommunication between rider and horse.

Lay person message: Although the German terms ‘Kreuz’ and ‘Kreuzanspannen’ are widely used in equestrian parlance, there are striking disagreements among practitioners of various qualification levels regarding what anatomical structures or actions these terms are supposed to refer to. Use of such inaccurate and poorly defined terms by riding instructors may considerably hinder riders’ learning of correct posture and aid application, and should therefore be discouraged as it hinders communication between riders and horses.

Keywords: Language; Communication; Back; Aids; Anatomy; Survey
Adaptive Management (AM) is a structured, iterative process of robust decision-making in the face of uncertainty which aims to reduce uncertainty over time via rigorous system monitoring. AM has primarily been used in situations of environmental uncertainty with those responsible for resource management and has produced positive outcomes when used in the training of custodians of land and animals. AM is a structured interactive process that involves making an informed intervention to an existing system, monitoring the resulting effects, then adapting and refining future interventions to improve the system’s condition over time. As more is becoming known about the horse, it is becoming widely recognised that substantial changes to horse management and training are needed if contemporary welfare requirements are to be met. Much of this change involves moving away from established, often traditional, practice that has largely been unquestioned. Uncertainty is a fundamental aspect of change and it is reasonable to expect any trainer, however experienced and proficient, to experience doubt about implementing new methods. Many are likely to have previously resisted change and the trialling of new training methods on the grounds of horse and human safety, and potentially an unspoken but entirely understandable ‘fear of the unknown’. When humans experience uncertainty they tend to revert to the familiar, even though the outcomes are known not to be the best or preferable. It is likely that practitioners beginning the process of changing their training methods to those encompassing the principles of learning will experience uncertainty. Since the AM approach provides a structured process for learning, reflection and refinement, it is proposed as a useful tool to support these practitioners. With support, the practitioner will be able to appraise the success of their training actions (namely the application of stimuli) and subsequent reaction (response), in relation to desired outcomes and comparison with past behaviour (desired and undesired) on an individual horse basis and evaluate it against a welfare framework. Successful actions can be repeated and those that failed to result in a successful outcome, not repeated. As successes become more frequent, practitioners’ confidence will increase and their application of stimulus–response–reinforcement will continue to improve, becoming more accurate, purposive, intuitive and welfare-friendly in their training. A dual approach based on informal AM (at the individual horse level) and formal AM which drives large-scale evidence-based adaptation of practice will result in global improvements to the welfare of horses used in equestrianism.

**Lay person message:** There is global recognition of the need to change horse training methods to those based on the principles of learning, however this is likely to create uncertainty for trainers. It is suggested that the Adaptive Management approach successfully used in environmental studies to reduce uncertainty in outcomes as a result of change, is applied in the horse training context. Through rigorous monitoring of the training conducted, and provision of support, trainers will be able to develop their confidence, train more effectively and consequently improve the welfare of the horses that they manage, train and, if applicable, compete.

**Keywords:** Equine; Training; Welfare; Change; Adaptive Management; Monitoring
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**GLOSSARY**

**Aid:** Any of the signals used to elicit responses in horses. Rein, leg, whip and spur aids are initially learned through negative reinforcement and then transformed to light aids (light rein, light leg, voice, seat) via classical conditioning. The difference between cues and aids is that aids may vary in intensity, whereas cues are typically of the same intensity. Traditionally, the aids are divided into two groups: natural aids and artificial aids. This distinction is misleading as it refers to what is ‘naturally’ available to the rider, but it neither identifies nor correlates with the two learning modalities through which the horse acquires its responses to the aids.

**Approach conditioning:** An operant conditioning technique that reduces flight behaviours using the natural tendency of horses to investigate and approach unknown objects, in combination with systematic desensitisation. The horse is encouraged to approach the object that it is fearful of, which then retreats as the horse approaches. The horse may then be signalled to stop before it reaches its fear threshold, so that the object retreats even further. The horse is then signalled to catch up. As soon as the horse slows its approach it is deliberately stopped and this is repeated until the horse comes as close as possible to the object. The horse usually becomes increasingly motivated to investigate the object.

**Blocking:** A form of interference with classical conditioning; once an animal has learned that a given stimulus predicts a certain event the animal may fail to learn new associations, i.e. a second stimulus may not become a conditional stimulus because learning has been blocked by the presence of the first conditional stimulus.

**Classical conditioning:** The process whereby an animal learns to correlate external events, e.g. the animal is presented to a neutral stimulus (e.g. a sound) which is followed by a biologically important stimulus (e.g. a noxious stimulus such as a shock, or a positive stimulus such as food). In equitation, classical conditioning is the process where learned responses are elicited from more subtle versions of the same signal or to entirely new signals, e.g. when a horse learns to react to voice commands, visual cues, or rider seat cues.

**Cognition:** The mechanisms by which animals acquire, process, store and act on information from the environment. The study of cognition covers many topics such as perception, learning, memory and communication.

**Conflict behaviour:** Stress-induced behavioural changes that arise from conflicting motivations, especially when avoidance reactions are prevented. Conflict behaviour may be agonistic behaviours, redirected aggression or displacement activities. If the stressor is recurrent, conflict behaviour may manifest as repetition and ritualisation of original conflict behaviours. Stereotypes and self-mutilation may develop from severe, chronic or frequent stressors. In equitation, conflict behaviours may be caused by application of simultaneous opposing signals (such as go and stop/slow) such that the horse is unable to offer any learned responses sufficiently and is forced to endure discomfort from relentless rein and leg pressures. Similarly, conflict behaviour may result from incorrect negative reinforcement, such as the reinforcement of inconsistent responses or lack of removal of pressure.

**Contact:** The connection of the rider’s hands to the horse’s mouth, of the legs to the horse’s sides and of the seat to the horse’s back via the saddle. The topic of contact with both hand and leg generates considerable controversy relating to the pressure that the horse should endure. In
classical equitation, contact with the rein and rider’s leg involves a light pressure (approximately 200g) to the horse’s lips/tongue and body, respectively. A heavy contact may cause progressive habituation leading to diminished reactions to rein and leg signals as a result of incorrect negative reinforcement and/or simultaneous application of the aids.

**Counter-conditioning:** A type of training based on the principles of classical conditioning that attempts to replace fear responses to a stimulus with more desirable responses. The term means training an animal to show a behaviour which is opposite or different to the one the trainer wishes to eliminate. The technique is widely used in combination with systematic desensitisation. By ensuring that the preferred behaviour is more rewarding, the animal learns to perform the new behaviour when exposed to the problematic stimulus.

**Cue:** An event that elicits a learned response.

**Ethogram:** A list of the type of behaviours performed by a species in a particular environment. The list includes precise descriptions of each behaviour. It is fundamental to any study of animal behaviour to define which behaviour types are being observed and recorded.

**Ethology:** The scientific and objective study of animal behaviour, usually with a focus on behaviour under natural conditions, and viewing behaviour as an evolutionarily adaptive trait.

**Extinction:** The disappearance of a previously learned behaviour when the behaviour is no longer reinforced. Extinction can occur in all types of behavioural conditioning, but it is most often associated with operant conditioning. When implemented consistently over time, extinction results in the eventual decrease of the undesired behaviour, but in the short-term the animal may exhibit an extinction burst.

**Extinction burst:** A sudden and temporary increase in the frequency or magnitude of a behaviour, followed by the eventual decline and extinction of the behaviour targeted for elimination. Extinction bursts are more likely to occur when the extinction procedure is in the early stages.

**Flooding (response prevention):** A behaviour modification technique where the animal is exposed to an overwhelming amount of the fear-eliciting stimulus for a prolonged period of time while avoidance responses are prevented, until the animal’s apparent resistance ceases. The method is generally not recommended because there are severe risks associated with the method, e.g. injuries due to exaggerated fear reactions.

**Foundation training:** The basic training of a young horse to respond to aids and cues that control its gait, tempo, direction and posture for whatever purpose may be required. Foundation training may also include habituation to saddle and rider.

**Freeze:** The sudden alert motionless stance associated with a highly attentive reaction to an external stimulus.

**Habituation:** The waning of a response to a repeated stimulus that is not caused by fatigue or sensory adaptation. Habituation techniques include systematic desensitisation, counter-conditioning, over-shadowing, stimulus blending and approach conditioning.

**Hard/tough-mouthed:** Describes horses that have habituated to rein pressure. This is generally a result of incorrect negative reinforcement and can result in learned helplessness and conflict behaviours.
HPA axis (Hypothalamic–Pituitary–Adrenal axis): An organ system comprising the hypothalamus, the pituitary gland and the adrenal gland. The activation of the HPA axis is heightened when an animal is challenged with a stressor, and HPA axis products, such as cortisol, can serve as a physiological indicator of stress in animals.

Hyper-reactive behaviour: Behaviours characteristic of an activated HPA axis and associated with various levels of arousal. Such behaviours typically involve the horse having a hollow posture and leg movements with increased activity and tempo, yet shorter strides. Hyper-reactive behaviours are quickly learned and resistant to extinction because of their adaptiveness in the equid ethogram. Behavioural evidence of hyper-reactivity ranges from postural tonus to responses such as shying, bolting, bucking and rearing.

Learned helplessness: A state in which an animal has learned not to respond to pressure or pain. It arises from prolonged exposure to aversive situations or insufficient environments without the possibility of avoidance or control. It may occur from inappropriate application of negative reinforcement or positive punishment, which results in the horse being unable to obtain release from or avoid the aversive stimuli. If this continues over a period of time the horse will no longer make responses that were once appropriate, even if they would be appropriate under the present conditions.

Negative punishment (subtraction punishment): The removal of something pleasant (such as food) to punish an undesired response and thus decrease the probability of that response.

Negative reinforcement (subtraction reinforcement): The removal of something aversive (such as pressure) to reward a desired response and thus increase the probability of that response.

Operant conditioning (instrumental conditioning): The process whereby an animal learns from the consequences of its responses, i.e. through positive or negative reinforcement (which will increase the likelihood of a behaviour), or through positive or negative punishment (which will decrease the likelihood of a behaviour).

Overshadowing: The effect of two signals of different intensity being applied simultaneously, such that only the most intense/relevant will result in a learned response. It can explain why animals sometimes fail to associate the intended cue with the desired behaviour in favour of a different stimulus that was happening unintentionally at the same time and which was more relevant to the animal. The term overshadowing also denotes a desensitisation technique where habituation to a stimulus is facilitated by the simultaneous presentation of two stimuli that elicit a withdrawal response (such as lead rein cues/pressure and clippers or a needle).

Positive punishment (addition punishment): The addition of something unpleasant to punish an undesired response and thus decrease the probability of that response. Incorrect use of positive punishment can lower an animal’s motivation to trial new responses, desensitise the animal to the punishing stimulus and create fearful associations.

Positive reinforcement (addition reinforcement): The addition of something pleasant (such as food or a pleasant scratch) to reward a desired response and thus increase the probability of that response.

Punishment: The process in which a punisher follows a particular behaviour so that the frequency (or probability) of that behaviour decreases. See also Positive punishment and Negative punishment.
Reinforcement: The process in which a reinforcer follows a particular behaviour so that the frequency (or probability) of that behaviour increases. See also Positive reinforcement and Negative reinforcement.

Reinforcement schedule: The frequency of the reinforcers used in training. The schedule may be continuous, intermittent or declining.

Reinforcer: An environmental change that increases the likelihood that an animal will make a particular response, i.e. a reward (positive reinforcer) or removal of an aversive stimulus (negative reinforcer).

- **Primary reinforcer**: A stimulus that is considered naturally rewarding (e.g. food).
- **Secondary reinforcer**: A stimulus that has become associated with a rewarding stimulus and thus has been conditioned to be rewarding for the horse (e.g. the sound of a clicker which has been associated with a food reward).

Shaping: The successive approximation of a behaviour toward a targeted desirable behaviour through the consecutive training of one single quality of a response followed by the next.

Stereotypy: A repeated, relatively invariant sequence of movements that has no function obvious to the observer. Stereotypies are abnormal behaviours and are generally considered as a sign of impaired welfare. Stereotypic behaviour arises from frequent or chronic stress and may help the animal to cope with adverse conditions. The behaviours may persist even if the triggering factors are eliminated. A number of stereotypic behaviours, such as box-wandering, pacing and crib-biting are seen in horses and are erroneously referred to as stable vices.

Stimulus blending: A desensitisation technique that uses a closely resembling stimulus, to which the horse is already habituated, to systematically desensitise the horse to the fear-inducing stimulus. The fear-inducing stimulus is applied simultaneously with the known, non-fear-inducing stimulus, and then systematically increased in intensity. The aural and tactile characteristics of the two stimuli are gradually mixed, making identification of the new one difficult and different. The old benign stimulus can then be diminished and finally terminated after which the horse will show habituation also to the new stimulus.

Stimulus control: The process by which a response becomes consistently elicited by a light aid or cue.

Stress: Stress is a state which is characterised by the behavioural and physiological responses elicited when an individual perceives a threat to its homeostasis (‘internal balance’). The threat is termed a stressor.

Stressor: Anything that disrupts homeostasis, e.g. physical and psychological threats incl. lack of fulfilment of natural behavioural needs. Stressors appear to be stressful to the extent they contain elements of loss of control, loss of predictability, and absence of outlets for frustration.

Stress response: The body’s adaptations evolved to re-establish homeostasis. Stress responses are elicited when an animal anticipates or faces a stressor and involves a range of endocrine and neural systems. The responses are somewhat non-specific to the type of stressors that trigger them. Stress responses are in nature adaptive; however, when these responses are provoked for a long duration or repeatedly, they can cause negative effects such as increased susceptibility for
diseases, gastric ulceration, abnormal behaviour, reproduction problems and reduced performance.

**Systematic desensitisation:** Systematic desensitisation is a commonly used behaviour modification technique for the alleviation of behaviour problems caused by inappropriate arousal. In a controlled situation, the animal is exposed to low levels of the arousing stimulus according to an increasing gradient, until habituation occurs. An increase in the level of the stimulus is not made until the animal reliably fails to react to the previous level. In this way, the technique aims to raise the threshold for a response. The decrease in arousal can be reinforced by either negative or positive reinforcement.
## THE QUADRANT OF REINFORCEMENT AND PUNISHMENT

<table>
<thead>
<tr>
<th></th>
<th><strong>Reinforcement</strong></th>
<th><strong>Punishment</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>Increase in Likelihood</strong></td>
<td>Increases the likelihood of a behaviour</td>
<td>Decreases the likelihood of a behaviour</td>
</tr>
<tr>
<td><strong>Negative</strong></td>
<td>The removal of an aversive stimulus to reward a desired response</td>
<td>The removal of a desired stimulus to punish an undesired response</td>
</tr>
<tr>
<td>(Subtraction)</td>
<td><em>Ex. Rein tension is applied until the horse stops and the removal of the tension rewards the stopping response.</em></td>
<td><em>Ex. The horse begs for food but food is withheld until the behaviour ceases.</em></td>
</tr>
<tr>
<td><strong>Positive</strong></td>
<td>The addition of a pleasant stimulus to reward a desired response</td>
<td>The addition of an aversive stimulus to punish an undesired response</td>
</tr>
<tr>
<td>(Addition)</td>
<td><em>Ex. The horse approaches when called for and receives a carrot.</em></td>
<td><em>Ex. The horse bites and receives a slap on the muzzle.</em></td>
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</table>

The ‘scientific process’ comprises the six steps listed below. The application of statistics is a tool which enables reliable conclusions to be reached and the research objective to be answered. Statistical analysis is not that difficult and simply involves following a series of simple steps and rules. An example is used to demonstrate the steps required for a simple scenario where the researcher needs to apply the two sample t test in order to statistically assess the difference between two sets of data. (All text relating to the example given is highlighted with grey shading.)

1. Generating a research question
A good project will have a simple title which clearly describes the objective of the study.

Is there a difference in the success of dressage horses trained using Method A and Method B?

2. Identifying variables and measures
There are two types of variables – independent variables which are determined by the researcher and dependent variables which provide the measurements upon which statistical tests are conducted.

The Independent Variable is ‘Training method’ and has two levels:

3. Formulating hypotheses
All research projects rely on the examination of hypotheses. Each statistical analysis relies on the simultaneous examination of a pair of hypotheses which are opposites of each other and always follow the standard format:

- The Null Hypothesis (Ho) states that ‘There is no significant difference between A and B’.
- The Alternative Hypothesis (Ha/H1) states that ‘There is a significant difference between A and B’.

Ho: There is no significant difference in the dressage scores achieved by horses trained using Method A and the dressage scores achieved by horses trained using Method B.
Ha: There is significant difference in the dressage scores achieved by horses trained using Method A and the dressage scores achieved by horses trained using Method B.

4. Designing the experiment ~ data collection
When designing an experiment it is important to obtain a decent sample size (n, as a rough guide is that anything less than 30 is considered to be a ‘small’ sample) and to match everything about the individuals contributing to each sample as evenly as possible.

All of the horse and rider combinations in this study will be competing at a similar level, and performing the same dressage test, under the same conditions.
Two types of data analysis are applied: first, exploratory, descriptive analysis which provides averages and an indication of the spread of the data; and second, confirmatory statistical analysis which yields ‘test statistics’ and probabilities and ultimately allows a statistical conclusion to be reached. The latter will then allow a conclusion to be reached in relation to the objective of the study.

**Exploratory, descriptive analysis** of the sample data shows that horses trained using Method A achieve an average score of 55.7% with a variability of 4.93% typically presented as 55.7±4.93%. Horses trained using Method B achieved a higher score of 67.4±5.80%.

**Confirmatory, statistical analysis** is necessary in order to reach a reliable conclusion. A standard process is now followed:

- Conduct a statistical test (here the two sample t test). This will produce a test statistic and a probability value, P.

**6. Reach a conclusion**

In statistics there is a one important number: **P=0.05**.

A P value of 0.05 means that if a study was repeated 100 times then 95 times out of 100 the same result would be found, and 5 times out of 100 the opposite result would be gained. As far as interpretation of results goes, the P value should be less than 0.05 in order for the results to be considered to be reliable.

In order to reach a statistically sound conclusion, a simple procedure is followed to relate the P value to the hypotheses:

- If the P value obtained is less than 0.05, the Ha is accepted and the Ho is rejected. The conclusion is then reached that there is a significant difference between the two samples. The averages found in exploratory data analysis show that training Method B is more successful than Method A.

- If the P value obtained is equal to, or greater than, 0.05, the Ho is accepted and the Ha is rejected. The conclusion is then reached that there is not a significant difference between the two samples. (Here scientists state that there is a non-significant difference.)
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